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Taxonomy and systematics

Richness analysis and completeness of the scorpion fauna of Aguascalientes, Mexico with an identification key to species

Análisis de riqueza y completitud de la escorpiofauna de Aguascalientes, México, con una clave de identificación de especies

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Abstract

The scorpion fauna of the state of Aguascalientes was revised based on specimens deposited in scientific collections and fieldwork. We evaluated the completeness of the scorpion species inventory of the Colección Zoológica of the Universidad Autónoma de Aguascalientes (CZUAA) based on nonparametric estimators. The results indicate that the number of species increased from 11 to 13, recording for the first time *Chihuahuanus glabrimanus* (Sissom & Hendrixson, 2005), a psammophilic species, and *Centruroides balsasensis* Ponce-Saavedra and Francke, 2004, a medically relevant species for public health. Finally, an identification key to the scorpion species of Aguascalientes is provided and a recount of ecological and biological traits of the species herein is studied.

Keywords: *Chihuahuanus glabrimanus*; *Centruroides balsasensis*; Species list; Parthenogenesis; Scientific collections

Resumen

Se revisó la escorpiofauna del estado de Aguascalientes con base en ejemplares depositados en colecciones científicas y trabajo de campo. Se evaluó la completitud del inventario de especies de escorpiones de la Colección Zoológica de la Universidad Autónoma de Aguascalientes (CZUAA) mediante métodos no paramétricos. Los resultados indican un aumento del inventario de 11 a 13 especies; se registra por primera vez a la especie psamofílica *Chihuahuanus glabrimanus* (Sissom y Hendrixson, 2005) y la especie de importancia para la salud pública *Centruroides balsasensis* Ponce-Saavedra y Francke, 2004. Finalmente, se brinda una clave de identificación de especies de escorpiones de Aguascalientes, así como un recuento de caracteres ecológicos y biológicos de las especies estudiadas.

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Palabras clave: *Chihuahuanus glabrimanus*; *Centruroides balsasensis*; Listado de especies; Partenogénesis; Colecciones científicas

Introduction

With an area of 5,589 km^2 (INEGI, 2019), the state of Aguascalientes lies in the central region of Mexico. It is the fourth smallest state in Mexico with 11 municipalities (Sandoval-Ortega et al., 2017; Sigala-Rodríguez & Greene, 2009). Despite this overshadowing territory compared to other states in Mexico, such as Chihuahua, Aguascalientes comprises 3 biogeographic provinces: Sierra Madre Occidental (SMO), Chihuahuan Desert (CD), and Pacific Lowlands (PL) (Morrone et al., 2017) (Fig. 1). Three general types of climatic groups are associated with predominant plant communities in the state: arid zone covered by xerophytic vegetation, temperate zone with oak forest or mixed forests, and the tropical zone covered by secondary subtropical vegetation (Siqueiros-Delgado et al., 2017).

Although formal scorpion fauna studies have been done in the state, the first mention of scorpions distributed in Aguascalientes was presented by Hoffmann (1931, 1932, 1936), who listed 7 species in total: *Centruroides infamatus* C. L. Koch, 1844; *Chihuahuanus bilineatus* Pocock, 1898; *Diplocentrus zacatecanus* Hoffmann, 1931; *Mesomexovis spadix* Hoffmann, 1931; *Paruroctonus gracilior* Hoffmann, 1931; *Thorellius intrepidus* Thorell, 1876 and *Vaejovis nigrescens* Pocock, 1898. Later, several authors contributed to the knowledge of the species list (Contreras-Félix et al., 2015; Chávez-Samayoa et al., 2022; Escoto-Rocha & Delgado-Zaldívar, 2008), which is currently composed of 11 species. At present, there are no published identification keys for the scorpions of Aguascalientes, therefore researchers must rely on other works (González-Santillán & Prendini, 2013, 2018; Ponce-Saavedra & Francke, 2013a; Ponce-Saavedra et al., 2016), where part of the scorpion fauna is described and keyed.

Established in 1978, the Colección Zoológica of the Universidad Autónoma de Aguascalientes (CZUAA), preserves specimens collected during the formation of biology students (De la Riva-Hernández, 2014). The first scorpion collected and deposited in the CZUAA dates to 1979. Subsequently, numerous biology students, professors, and the public have contributed with samples recording the state's species richness. Escoto-Rocha and Delgado-Zaldívar (2008) presented a species list derived from the study of the specimens deposited in the CZUAA, where they listed 9 species. In this contribution we update the knowledge of the scorpion species distributed in Aguascalientes and provide an identification key at the

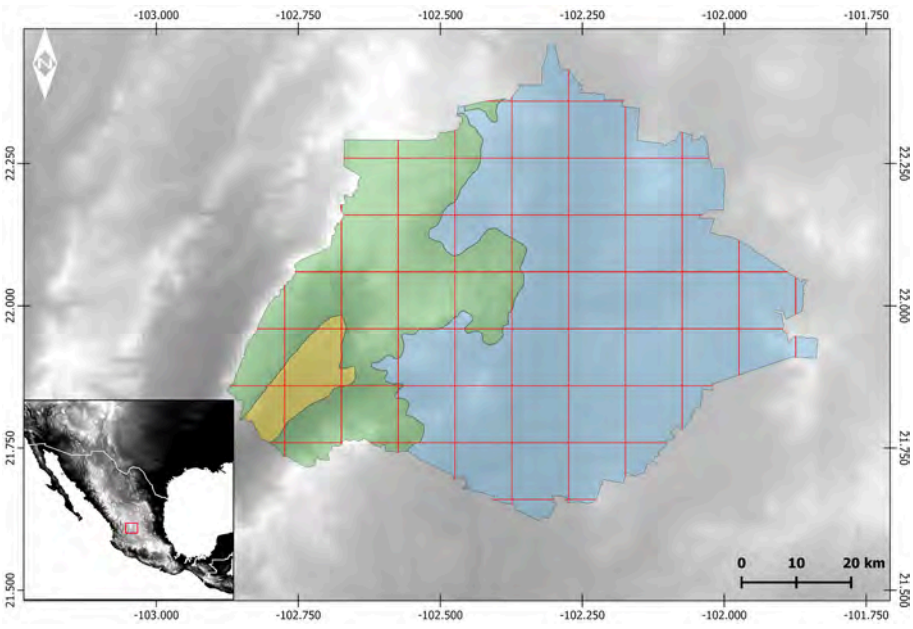

Figure 1. Biogeographic provinces of the state of Aguascalientes (Morrone, 2017). Chihuahuan Desert (CD) is highlighted in blue, Pacific Lowlands (PL) in yellow, and Sierra Madre Occidental (SMO) in green.

Figure 2. Chelicerae of *C. infamatus* (A), *M. spadix* (B) and *P. gracilior* (C). Abbreviations: b, basal; d, distal; ed, external distal; id, internal distal; m, medial, sd, subdistal, vm, ventral median.

species and genus levels for the first time. Furthermore, an evaluation of the alpha diversity using non-parametric estimators is computed. Although, examined material deposited in the CZUAA is the primary source, we studied scorpions deposited in the Colección Nacional de Arácnidos (CNAN) to corroborate taxonomical identities.

Materials and methods

To determine the species taxonomic identity, the following identification keys and species descriptions were used: Buthidae: Ponce-Saavedra and Francke (2013a), Ponce-Saavedra et al. (2016); Diplocentridae: Santibáñez-López and Francke (2013); Vaejovidae: Contreras-Félix and Francke (2019), González-Santillán and Prendini (2013, 2018), Sissom and González-Santillán (2004), Sissom and Hendrixson (2005). Digital microphotographs were taken with a Leica EZ4HD stereoscope and habitus with a Nikon Z7. All photographic edition was made with Adobe Photoshop CS5.1.

Nomenclature and homology follow González-Santillán and Prendini (2013), except for cheliceral dentition (Sissom, 1990). We proposed a name to identify a distinctive but unnamed denticle of the family Buthidae as the ventral medial denticle of the cheliceral fixed finger (Fig. 2A). This denticle lies between the distal and subdistal denticles but on the ventral surface. This denticle is a diagnostic character —and probably a synapomorphy— for the family Buthidae (Sissom, 1990) and thus is only present in the 2 species of the genus *Centruroides*.

Several authors have used museum and collection label data to estimate species richness through nonparametric estimators, overcoming the fact that this kind of data suffers from a standardized sampling effort, but at the same time, recognizing the value of this information as an estimate of inventory completeness (Basualdo, 2011; Beck & Kitching, 2007; Fattorini, 2013; Guralnick & Van Cleve, 2005; Meier & Dikow, 2004; Petersen & Meier, 2003; Petersen et al., 2003; Soberón-Mainero et al., 2000).

Collection records deposited in the CZUAA were georeferenced remotely using Google Earth Pro 7.3.4.8248 and, in some cases, directly registered during fieldwork using a Garmin eTrexH GPS. We generated 2 incidence databases, one considering spatial and another temporal species accumulation. For the spatial perspective, we created a layer with a grid of 0.025° × 0.025° —approximately 10 × 10 km— cells, recording the appropriated incidence (0 = absence, 1 = presence) per species (Appendix 1). For the temporal species accumulation, we divided the species incidence into classes of 5 years from 1979 to 2022 (Appendix 2). Diversity analyses were conducted using the function specpool of the R package vegan (Oksanen et al., 2019). *Centruroides balsasensis* was excluded from this analysis because we consider it an introduced species. Distributional maps with an elevation model (Fick & Hijmans, 2017) were generated with QGIS 3.16.

Acronyms used in the records are as follow: AMCC, Ambrose Monell Cryocollection at AMNH; AMNH, American Museum of Natural History; BM, British Museum; CAS ARA, California Academy of Sciences, Arachnid collection; CIBUAEM, Colección de Entomología del Laboratorio de Parasitología Vegetal del Centro de Investigaciones Biológicas de la Universidad Autónoma del Estado de Morelos; CNAN-SC, Colección Nacional de Arácnidos, Scorpion Collection; CZUAA SCO, Colección Zoológica de la Universidad Autónoma de Aguascalientes, Scorpion Collection; ENCB IPN, Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional; FSCA, Florida State Collection of Arthropods; GL, Graeme Lowe's personal collection; INDRE, Instituto Nacional de Diagnóstico y Referencia Epidemiológica; JCC, J. C. Cockendolpher's personal collection; MES,

Michael E. Soleglad's personal collection; MNHN, Museum National d´ Historie Naturelle; MWSU, Midwestern State University; SAM, Indiana University School of Medicine; SAS, S. A. Stockwell's personal collection; TMM, Texas Memorial Museum; TOR, Museo ed Instituto di Zoologia Sistematica della Universita di Torino, Italy; UAQ, Universidad Autónoma de Querétaro; UCLB, University of California Long Beach; VF, Victor Fet's personal collection; WDS, W. D. Sissom's personal collection; WTAMU, West Texas A & M University. Notice that some records from the literature are devoid of numerical code because they were not found in the CNAN despite the authors listing them in their publications.

Results

We examined 934 specimens and identified 13 species corresponding to the families Buthidae, Diplocentridae, and Vaejovidae (Table 1). The results of analyses of non-parametric estimators using spatial and temporal approaches reflected similar completeness of Aguascalientes biodiversity (Table 2). Under the 10 × 10 km grid approach, all estimators produced coverage of over 80%, the lowest for first order Jackknife at 85.7% and the highest for Jackknife 2 at 100%. On the other hand, the estimation constructed through the 5-year classes lays a higher percentage of coverage, the lowest for Bootstrap at 92.3% and the highest Jackknife 2 at 100%. The overall most conservative estimation was 85.7%, and the least conservative one was 100%.

Buthidae (C.L. Koch, 1837)
Subfamily Centruroidinae Kraus, 1955
Centruroides balsasensis Ponce-Saavedra & Francke, 2004 (Fig. 3)

Taxonomic summary

Holotype specimen: was not localized in the CNAN. The only available information from the original description is as follow: "*El holotipo es un macho adulto recolectado en Churumuco, municipio del mismo nombre en Michoacán, México el 08 de junio de 2000 por Erwin P. Miranda*

Table 1
Updated scorpion species list of the state of Aguascalientes.

Buthidae	*Centruroides balsasensis* Ponce-Saavedra & Francke, 2004
	Centruroides infamatus (C. L. Koch, 1844)
Diplocentridae	*Diplocentrus zacatecanus* Hoffmann, 1931
Vaejovidae	*Chihuahuanus bilineatus* (Pocock, 1898)
	Chihuahuanus coahuilae (Williams, 1968)
	Chihuahuanus glabrimanus (Sissom & Hendrixson, 2005)
	Mesomexovis spadix (Hoffmann, 1931)
	Thorellius intrepidus (Thorell, 1876)
	Paruroctonus gracilior (Hoffmann, 1931)
	Vaejovis aguazarca Díaz-Plascencia & González-Santillán,2022
	Vaejovis aquascalentensis Chávez-Samayoa & González-Santillán, 2022
	Vaejovis nigrescens Pocock, 1898
	Vaejovis tenamaztlei Contreras-Félix, Francke & Bryson Jr., 2015

Table 2
Nonparametric estimators of species richness. Abbreviations as follows: Boot = bootstrap estimator; Boot.se = standard error for bootstrap estimator; Chao = Chao estimator; Chao.se = standard error for chao estimator; DB = database, (1) 10 × 10 km grids as spatial units, (2) 5 years classes; Jack1 = first order Jackknife; Jack1.se = standard error for first order Jackknife; Jack2 = second order Jackknife; N = number of units; Sp = number of observed species.

DB	Sp.	Chao	Chao.se	Jack1	Jack1.se	Jack2	Boot	Boot.se	N
1	12	12.24	0.71	12.98	0.98	12.04	12.72	0.77	61
2	12	12	0	12	0	10.63	12.24	0.72	9

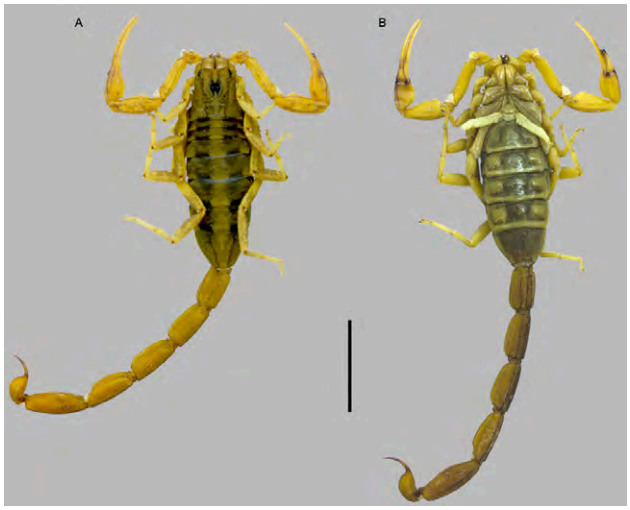

Figure 3. Habitus of female of *C. balsasensis*, scale = 1 cm.

López y será depositado en la Colección Nacional de Arácnidos del Instituto de Biología de la Universidad Nacional Autónoma de México (CNA-IBUNAM)".

Records from literature: Córdova-Athanasiadis (2005): México, Morelos, Municipality of Amacuzac: Huajuntlán, 18°36'36.00" N, 99°25'48.00" W, 1,510 m, 4-09-2004, M. Córdova, A. Gotilla, 5 ♀, CNAN-SC106. San Gabriel de las Palmas, 18°36'36.00" N, 99°21'00.00" W, 1,420 m, 4-09-2004, M. Córdova, A. Gotilla, 8 ♀, CNAN-SC131. Municipality of Axochiapan: Quebrantadero, 18°31'48.00" N, 98°47'24.00" W, 1,280 m, 2-09-2003, M. Córdova, D. Morán, 8 ♀, 6 ♂, 2 juv., CNAN-SC105. Municipality of Coatlán del Río: El Oyanco, 18°43'48.00" N, 99°25'48.00" W, 1,022 m, 6-08-2004, M. Córdova, O. Sotelo, 17 ♀, 6 ♂, CNAN-SC132. Municipality of Emiliano Zapata: Temimilcingo, 18°44'24.00" N, 99°09'00.00" W, 1,060 m, 28-04-2004, M. Córdova, A. Jaimes, 6 ♀, 4 ♂, CNAN-SC74. Municipality of Jonacatepec: Chalcatzingo, 18°40'48.00" N, 98°46'12.00" W, 1,371 m, 5-04-2004, M. Córdova, D. Morán, 11 ♀, 6 ♂, CNAN-SC978. Las Trancas, 13-11-1938, 2 ♀, CNAN-SC185. Municipality of Miacatlán: Palpan, 18°51'00.00" N, 99°25'12.00" W, 1,587 m, 7-08-2004, M. Córdova, O. Vázquez, 3 ♀, CNAN-SC93. Municipality of Temixco: Pueblo Viejo, 18°52'12.00" N, 99°15'00.00" W, 1,378 m, 11-06-2004, M. Córdova, A. Jaimes, O. Sotelo, 6 ♀, 6 ♂, 1 juv., CIBUAEM. Municipality of Tepalcingo: Cerro del Venado, 18°36'36.00" N, 98°51'36.00" W, 1,380 m, 1-09-2003, M. Córdova, D. Morán, 17 ♀, 9 ♂, CNAN-SC80. El Limón, 18°32'24.00" N, 98°55'48.00" W, 1,191 m, 12-09-2004, M. Córdova, G. Obregón, 4 ♀, 7 ♂, CIBUAEM. Municipality of Tlaltizapán: Barranca Honda, 18°49'12.00" N, 99°06'00.00" W, 1,200 m, 20-06-2004, M. Córdova, M. Barrios, 4 ♀, 2 ♂, CNAN-98; M. Córdova, M. Barrios, 1 ♀, 18 juv., CNAN. Municipality of Tlalquiltenango: Chimalacatlán, 18°27'36.00" N, 99°06'00.00" W, 1,066 m, 11-07-2004, M. Córdova, O. Sotelo, 4 ♀, 5 ♂, CNAN-SC976. Huautla, 18°23'24.00" N, 99°01'48.00" W, 976 m, 12-07-2004, M. Córdova, A. Jaimes, 17 ♀, 8 ♂, 1 juv., CNAN-SC81; 1 ♀, 24 juv., CNAN; 18°26'24.00" N, 99°01'12.00" W, 11-06-1994, A. Burgos, 3 ♀, CIBUAEM. Quilamula, 18°31'12.00" N, 99°01'12.00" W, 1,100 m, 7-06-2004, M. Córdova, E. Maison, 2 ♀, 3 juv., CIBUAEM; 15-08-2003, M. Córdova, A. Jaimes, H. Lagunas, 11 ♀, 9 ♂, 2 juv., CNAN-SC165. Xicatlacotla, 18°33'36.00" N, 99°13'48.00" W, 812 m, 26-06-2004, M. Córdova, 1 ♀, 28 juv., CNAN-SC917; 3♀, CIBUAEM. Xalostoc, 18°43'12.00" N, 98°54'00.00" W, 1,602 m, 21-11-2003, M. Córdova, 6 ♀, 1 ♂, CNAN-SC159. Municipality of Yautepec: San Isidro, 18°49'12.00" N, 99°06'00.00" W, 1,378 m, 20-06-2004, M. Córdova, M. Barrios, 5 ♀, 1 ♂, CNAN-SC96; 1 ♀, 19 juv., CNAN. Municipality of Zacatepec: Galeana, 15-08-1991, G. Peña, 4 ♀, 3 ♂, 2 juv., CIBUAEM. Zacatepec, 30-06-1981, F. Guerrero, 3 ♀, CNAN-SC118. Municipality of Zacualpan de Amilpas: El Curiel, 18°46'48.00" N, 98°45'36.00" W, 1,668 m, 31-07-2004, M. Córdova, O. Sotelo, A. Sotelo, 18 ♀, 4 ♂, 1 juv., CNAN-SC79. Ponce-Saavedra & Francke (2004): México, Guerrero, Municipality of Tzirándaro: 18°28'25" N, 100°57'17" W. Michoacán, Municipality of Apatzingán: Altamira, El Tesorero, 18°57'42" N, 102°22'58" W. Las Anonas, 18°51'36" N, 102°35'00" W. Valle Verde, 19°02'54" N, 102°23'18" W. Municipality of Arteaga: El Descansadero, 19°34'17" N, 101°49'17" W. El Puerto, road to Tumbiscatío, 18°09'18" N, 102°23'18" W. Las Cañas, 18°33'20" N, 101°58'19" W. Municipality of Buenavista Tomatlán: Buenavista, 19°120'24" N, 102°35'12" W. El Puerto, 19°14'48" N, 102°35'37" W. Municipality of Carácuaro: 19°00'54" N, 102°07'05" W. Km 4 from San Antonio de las Huertas towards Carácuaro, 19°06'13" N, 101°12'06" W. Municipality of Churumuco: Cerro de Las Letras, 18°39'37" N, 101°39'17" W. Churumuco, 18°39'48" N, 101°38'64" W. El Ahuijote, 18°42'30" N, 101°46'00" W. Potrero de Corpus, El Chocolate, 18°52'48" N, 101°37'47" W. Municipality of Gabriel Zamora: Cerro de la Cruz, 19°09'55" N, 102°04'03" W. El Jagüey, 19°10'49" N, 102°01'24" W. El Ranchito, 19°11'00" N, 102°03'11" W. Km 128 Morelia-L.C road, 19°04'51" N, 102°00'59" W. Municipality of Huacana: Presa de Zicuirán, 18°55'18" N, 101°55'49" W. Municipality of Huetamo: road to Baztán, near El Rodeo, 18°46'13" N, 100°59'54" W. Cerro de Turitzio, near Arúa, 18°31'49" N, 100°55'45" W. Municipality of Mújica: Km 135 road La

Huacana-Cuatro Caminos, 18°31’49” N, 100°55’45” W. Nueva Italia, 19°01’24” N, 102°05’30” W. Municipality of Nuevo Urecho: breach towards Nueva Jerusalem, 19°05’06” N, 101°30’15” W. Km 3.8 road Puruarán-Turicato, 19°’05’48” N, 101°30’24” W. Municipality of Parácuaro: La Tuna, 19°05’48” N, 102°13’55” W. Municipality of San Lucas: 18°35’12” N, 100°47’11” W. Municipality of Tacámbaro: Arroyo Frío, 19°10’53” N, 101°28’30” W. Municipality of Taretán: 19°20’00” N, 101°55’05” W. Municipality of Tepalcatepec: El Taixtán, 19°00’49” N, 102°59’12” W. Estado de México, Municipality of Tejupilco: 1 km SE of Mango Matus, 18°40’00” N, 100°26’39” W. Quijano-Ravell & Ponce-Saavedra (2016): México, Michoacán, Municipality of Churumuco: 18°39’39.00” N, 101°38’46.00” W, 4 ♀, 3 ♂. Municipality of Huetamo: Arúa, 18°32’25.00” N, 100°55’35.00” W, 3 ♀, 4 ♂. Reyes-Moya et al. (2021): Mexico, Chihuahua, Municipality of Ciudad Juárez: 31°38’31” N,106°26’34.4” W, 03/04-2019.

Examined material: México, Aguascalientes, Municipality of Aguascalientes: Universidad Autónoma de Aguascalientes, 18-05-2012, N. Ubario-Guevara, 1 ♀, CZUAA SCO-107; 15-05-2016, A. A. Martínez-Durón, 1 ♀, CZUAA SCO-411. Jardín Botánico Rey Netzahualcóyotl, 25-04-2014, J. E. Gutiérrez-Montoya, 1 ♀, CZUAA SCO-106; 04-2015, J. E. Díaz-Plascencia, 3 ♀, CZUAA SCO-108. Fraccionamiento Casa Blanca, 13-04-2016, M. A. Delgado, 1 ♀, CZUAA SCO-434. Fraccionamiento El Dorado, 14-10-2019, 1 ♀, CZUAA SCO-551. Tlaxcala #107, colonia San Marcos, 21-06-2020, V. Esparza, 4 ♀, CZUAA SCO-535. Pozo Hondo 141, colonia Pozo Bravo, 29-06-2020, N. Palacios, 1 ♀, CZUAA SCO-546. Tlaloc 519, colonia Prados del Sur, 8-03-2022, I. Martínez, 1 ♀, CZUAA SCO-672. Municipality of Calvillo: Colomos, plantación de guayaba, 21°52’44.11” N, 102°39’16.70” W, 1,798 m, 27-01-2022, I. J. Rodríguez-Elizalde, J. Brito-Ruiz de Velasco, 1 ♀, CZUAA SCO-686; 29-08-2021, I. J. Rodríguez-Elizalde, J. Brito-Ruiz de Velasco, L. I. Rodríguez-Rodríguez, M. E. Herrera-Rodríguez, 1 ♀, CZUAA SCO-692. El Terrero, 17-04-2011, J. Ruvalcaba-Calderón, 1 ♀, CZUAA SCO-104. Los Adobes, 21°48’39.22” N, 102°41’21.34” W, 1,875 m, 17-09-2019, F. Chávez-Samayoa, L. R. Haro-Tapia, 4 ♀, CZUAA SCO-509; 21°48’39.22” N, 102°41’57.34” W, 1,875 m, 11-10-2019, F. Chávez-Samayoa, 2 ♀, CZUAA SCO-698. Calvillo, 10-11-2021, R. García, 2 ♀, CZUAA SCO-670. Municipality of Jesús María: Alegría #122, colonia Gómez Portugal, 23-03-2022, 1 ♀, CZUAA SCO-695. Cerro del Muerto, 8-05-2005, A. Ramírez, 1 ♀, CZUAA SCO-111. Michoacán, Municipality of Uruapan: F. A. Guerrero-Roque, 1 ♀, CZUAA SCO-54. Zacatecas, Municipality of Jalpa: 21-04-2016, V. E., 1 ♀, CZUAA SCO-407. Municipality of Juchipila: 25-04-2010, C. Y. Gómez-Aranzazú, 2 ♀, CZUAA SCO-102; 13-05-2000, D. Magaña-Ortíz, 1 ♀, CZUAA SCO-110.

Remarks

Other than the Churumuco site (18°39’48” N, 101°38’64” W), in the Michoacan Balsas Depression, *C. balsasensis* has been recorded in the states of Guerrero, Mexico, Morelos, and Puebla (Córdova-Athanasiadis, 2005; Ponce-Saavedra & Francke, 2004; Ponce-Saavedra et al., 2022; Santibáñez-López et al., 2015). However, the records from Morelos are questionable (González-Santillán & Possani, 2018).

Reyes-Moya et al. (2021) recently recorded *C. balsasensis* in Ciudad Juárez, Chihuahua, indicating that the species collected may represent an “accidental introduction” into the city likely due to (Ciudad Juárez is) “the northern largest and busiest border crossing of Mexico and the USA, experiencing massive local and non-local human transit”. We were able to examine some of the specimens cited in that contribution and concluded that they are not conspecific with *C. balsasensis*. We base our conclusion on the comparison of the following set of the characters readily observed in their published figures: *1)* there is an areola created by pigmentation circling each median ocellus on the carapace in Reyes-Moya et al. (2021, their Fig. 1A), whereas in the original description of Ponce-Saavedra & Francke, 2004 (their Fig. 9), in Quijano-Ravell & Ponce-Saavedra 2016 (their Fig. 6[2]), and in our figure 4A, the areola is not complete with the retrolateral area lacking pigmentation; *2)* the body length of the females in Reyes-Moya et al. (2021) is 37 and 40 mm, whereas in the original description, the body length is 60 and 73 mm, a difference of more than 20 mm; *3)* the pectens’ basal piece of the females is wider than longer (Reyes-Moya et al., 2021), but those of the original description are trapezoid, almost as long as wide, with a deep medial depression. The description of the specimens provided by Reyes-Moya et al. (2021), however, is more like *Centruroides sculpturatus*, particularly due to the pigmentation pattern of the carapace and tergites exhibited by phase 2 or 3 identified by Stahnke (1971). The likelihood of introduction from the Balsas Basin to Ciudad Juárez is considerably lower compared to the introduction of this species from Sonora or even Arizona because of the proximity of these areas. Our conclusion is that the specimens reported and illustrated by Reyes-Moya et al. (2021) are conspecific to *C. sculpturatus* instead of *C. balsasensis*.

We recorded *C. balsasensis* for the first time in Aguascalientes with 20 samples (32 individuals) from the Municipalities of Aguascalientes, Calvillo, and Jesús

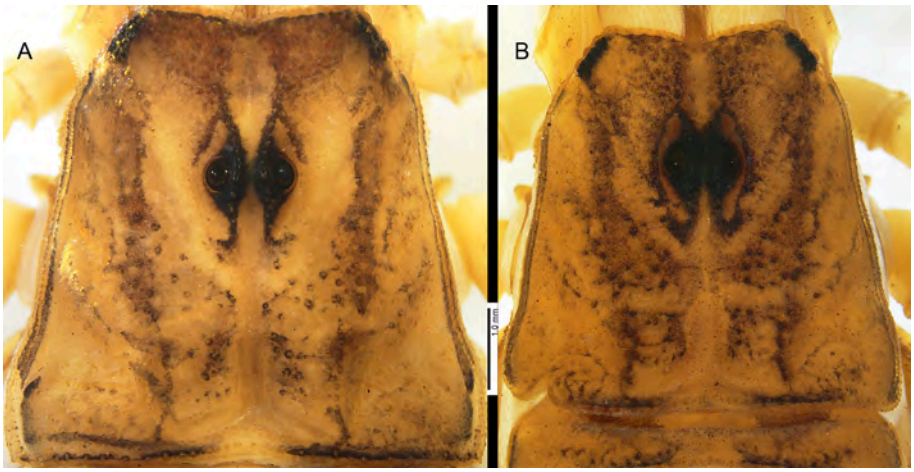

Figure 4. Carapace of *C. balsasensis* (A) and *C. infamatus* (B).

María. The first sample dates to 2005 (CZUAA SCO 111), and the most recent one to May 2023 (CZUAA SCO-732). Specimens deposited in the CZUAA were associated mainly with urban areas or meadows. Remarkably, we only observed adult or juvenile females; males are absent in the collection. It is likely that this species was transported accidentally and has invaded Aguascalientes and other northern states (we also examined 3 samples from Zacatecas: CZUAA SCO-102, CZUAA SCO-110, CZUAA SCO-407). However, further investigation to elucidate the establishment of this species is needed. Our data also suggest that the establishment of the population in Aguascalientes may have occurred by parthenogenesis due to the presence of only females in colonized urban and suburban areas. This hypothesis finds support by the occurrence of the same phenomenon in the South American species *Tityus serrulatus*, Lutz and Mello, 1922, which exhibits indigenous sexual populations and asexual populations in colonized habitats (Braga-Pereira & Santos, 2021). Intriguingly, this is also a medically relevant species in Brazil, suggesting parallel ecological mechanisms to establish in novel locations in different parts of the world.

Centruroides infamatus (C. L. Koch, 1844) (Fig. 5)

Taxonomic summary

Holotype specimen: Zoologisches Museum, Humbolt Universität, Berlin, Germany. Sex and type locality unknown (Fet & Lowe, 2000).

Records from literature: Esposito et al. (2018): México, Michoacán, Municipality of Tangamandapio: Los Tabanos, 19°58’29.64” N, 102°50’32.14” W, 223 m, 31-05-2006, O. F. Francke, H. Montaño, A. Valdez, A. Ballesteros, 2 ♀, AMCC (LP6420). Municipality of Tingambato: Tingambato 4 km W, under stones, 23-03-2000, E. González, 1 ♂, AMCC (LP1822). Ponce-Saavedra & Francke (2004): México, Guanajuato, Municipality of Romita: San Antonio del Pochote, 20°55’47.00” N, 101°33’48.00” W. Michoacán, Municipality of Coalcomán: 18°48’47.00” N, 103°09’57.00” W. Municipality of Morelia: 19°42’00.00” N, 101°11’18.00” W. Tiripetío, 19°32’00.00” N, 101°21’00.00” W. Municipality of Salvador Escalante: Salvador Escalante, 19°24’00.00” N, 101°38’18.00” W. Municipality of Uruapan: La Cofradía, 19°26’00.00” N, 102°01’00.00” W. Zumpimito, 19°22’18.00” N, 102°03’19.00” W. Ponce-Saavedra et al. (2009): México, Michoacán, Municipality of Uruapan: Zumipito, 19°21’25.00” N, 102°04’13,00” W, GenBank AF439753. Quijano-Ravell & Ponce-Saavedra (2016): México, Guanajuato, Municipality of León: 21°01’02.00” N, 101°37’44.00” W, 3 ♂ 2 ♀. Michoacán, Muncipality of Uruapan: Zumipito, 21°07’30.00” N, 101°01’49.00” W, 4 ♂ 4 ♀.

Examined material: Mexico, Aguascalientes, Municipality of Aguascalientes: Central de abastos, 02-1996, J. G. Estrada-A., 1 ♂, CZUAA SCO-54. Cerro de los Gallos, 21-10-1989, L. Silva-López, 1 ♀, CZUAA SCO-117; 26-04-1984, H. Gallegos-Rangel, 1 ♀, CZUAA SCO-118. Municipality of Calvillo: Cascada Los Huenchos, 21°52’52.90” N, 102°47’06.25” W, 1756 m, 22-05-2021, J. L. Reyes-Hernández, 1 ♂, CZUAA SCO-614. Cercano a balneario “La Cueva”, 21°48’47.70” N, 102°49’34.82” W, 28-09-2019, F. Chávez-Samayoa, L. R. Haro-Tapia, 1 ♀, CZUAA SCO-483; 15-10-2019, F. Chávez-Samayoa, 19 ♂, 10 ♀, CZUAA SCO-495; 19-10-2019, F. Chávez-Samayoa, 23 ♂, 12 ♀, CZUAA SCO-503. Cercano a restaurante “La Fragua”, 21°59’52.32” N, 102°40’35.36” W, 1,825

Figure 5. Habitus of male (top) and female (bottom) of *C. infamatus*, scale = 1 cm.

m, -05-2021, T. Huerta, 3 ♂, 2 ♀, CZUAA SCO-644. El Cuervero, 19-06-2004, A. D. González, 1 ♀, CZUAA SCO-162. El Zapote, 8-12-2021, R. García, 1 ♀, CZUAA SCO-666. Calvillo, 29-04-2017, E. M. Flores-Villalpando, 1 ♀, CZUAA SCO-431; 4-05-2017, A. Hernández, 1 ♀, CZUAA SCO-435. Crucero de las Pilas, 11-11-2020, R. García, 1 ♂, CZUAA SCO-700. La Calixtina, 16-05-2017, I. Rodríguez-Ortiz, 1 ♀, CZUAA SCO-424. La Labor, 10-04-2011, M. P. Ramírez-Guillen, 1 ♂, CZUAA SCO-139. La Mezquitera, 21°51’37.47” N, 102°46’04.20” W, 30-08-2019, F. Chávez-Samayoa, J. A. Escoto-Moreno, 1 ♂, 1 ♀, CZUAA SCO-484; 5-10-2019, F. Chávez-Samayoa,

23 ♂, 8 ♀, CZUAA SCO-508; 7-09-2019, F. Chávez-Samayoa, R. Haro-Tapia, 4 ♂, 2 ♀, CZUAA SCO-514; 10-10-2019, F. Chávez-Samayoa, 2 ♂, CZUAA SCO-558. Los Adobes, 21°48'39.22" N, 102°41'21.34" W, 1-09-2015, J. E. Díaz-Plascencia, 1 ♀, CZUAA SCO-330; 11-10-2019, F. Chávez-Samayoa, 15 ♂, 4 ♀, CZUAA SCO-480; 17-09-2019, F. Chávez-Samayoa, R. Haro, 26 ♂, 13 ♀, CZUAA SCO-497; 6-09-2019, J. A. Escoto-Moreno, F. Chávez-Samayoa, 1 ♂, CZUAA SCO-555. Los Alisos, 9-10-1989, J. Moreno-Lara, 1 ♂, CZUAA SCO-121; 2-06-1982, Z. M. Vela-Ortiz, 1 ♂, CZUAA SCO-133; 8-09-1984, Morales, Franco, Montoya, 1 ♂, CZUAA SCO-134; 19-06-2004, G. Guerrero, 1 ♀, CZUAA SCO-154. Los Lobos, 21-10-1990, J. A. Sánchez-García, 1 ♀, CZUAA SCO-129. Presa Malpaso, 19-06-2004, G. Villalobos, 1 ♂, CZUAA SCO-123; 3-05-1999, R. P. Arteaga-Hernández, 1 ♂, CZUAA SCO-125; 13-06-2004, E. Ortiz-Martínez, 1 ♂, CZUAA SCO-126; 20-03-1999, M. Morga, 1 ♂, CZUAA SCO-131; 3-05-1999, M. Martínez-Garnica, 1 ♀, CZUAA SCO-135; 26-11-1986, E. Alvizo-Flores, 1 ♀, CZUAA SCO-138. Palo Alto, 18-11-2021, R. García, 1 ♂, 3 ♀, CZUAA SCO-671; 20-11-2021, R. García, 4 ♂, CZUAA SCO-667. Presa La Codorniz, 22°00'39.07" N, 102°40'15.19" W, 1,894 m, 1-11-2020, E. González-Martínez, J. L. Reyes-Hernández, I. E. Gallegos-Vieyra, D. F. Simijaca-Salcedo, F. Chávez-Samayoa, 5 ♂, 5 ♀, CZUAA SCO-589; 21°59'50.78" N, 102°40'42.78" W, 2,068 m, 5-06-2021, F. Chávez-Samayoa, D. Ortiz-Álvarez, C. Huerta, 5 ♂, 10 ♀, CZUAA SCO-612. Presa La Ordeña, 25-04-2005, C. A. Díaz-Delgado, 1 ♀, CZUAA SCO-145. Presa de los Serna, 20-10-2003, S. García, 1 ♀ CZUAA SCO-124; 14-06-2004, S. García, 1 ♀, CZUAA SCO-137. San Tadeo, -04-1996, J. Martínez-de Lara, 1 ♀, CZUAA SCO-127; -05-2015, C. A. Franco-Servín de la Mora, 1 ♂, 2 ♀, CZUAA SCO-149. Sierra del Laurel, 25-10-1982, E. Padilla-R., 1 ♂, CZUAA SCO-128. Terrero de la Labor, 22°01'32.02" N, 102°39'58.00" W, 22-10-2021, F. Chávez-Samayoa, D. Ortiz-Álvarez, 25 ♂, 20 ♀, CZUAA SCO-655. Municipality of Jesús María: Cerro El picacho, 23-05-2014, E. A. Hernández-Medrano, 1 ♂, CZUAA SCO-109; 29-04-2016, D. Martínez, 1 ♂, CZUAA SCO-418. Municipality of Rincón de Romos: 17-04-2004, N. Arroyo-Chávez, 1 ♂, CZUAA SCO-112; 17-04-2004, A. F. Ramos-Martínez, 1 ♂, CZUAA SCO-113. Guanajuato, Municipality of Comonfort: 04-2007, D. García, 1 ♂, CZUAA SCO-402. Municipality of León: Fraccionamiento La Luz, 27-04-2013, V. H. González-Sánchez, 1 ♀, CZUAA SCO-75; 27-04-2003, K. A. de Luna-Gómez, 1 ♀, CZUAA SCO-85. León, 30-05-2009, C. García-Balderas, 1 ♀, CZUAA SCO-77; 13-06-2004, C. Moreno, 1 ♂, CZUAA SCO-84; 21-06-2004, M. A. Gómez, 1 ♂, CZUAA SCO-87; 4-06-2000, M. Chávez-Andrade, 1 ♂, CZUAA SCO-88; 7-06-2004, S. Flores, 1 ♂, CZUAA SCO-90; 15-06-2004, M. A. B. López, 1 ♂, CZUAA SCO-94; 16-06-2006, Miguel, 1 ♀, CZUAA SCO-96; R. A. Carbajal-Márquez, 1 ♀, CZUAA SCO-99. Municipality of Moroleón: Presa Quiahuyo, 25-03-2016, K. Rosales, 1 ♀, CZUAA SCO-445. Municipality of Pénjamo: 21-09-1983, O. A. Rodríguez, M. G. Flores, 1 ♀, CZUAA SCO-79. Municipality of Salamanca: L. Flores, 1 ♂, CZUAA SCO-70; J. A. Berlín-Diosdado, 1 ♀, CZUAA SCO-71. Municipality of Yuriria: 13-06-1991, V. Villalobos-Sánchez, 1 ♀, CZUAA SCO-74. Michoacán, Municipality of Uruapan: M. A. Domínguez-de la Riva, 1 ♀, CZUAA SCO-51. Municipality of Tancítaro: El Cuate, -04-1996, R. E. Martínez, 1 ♀, CZUAA SCO-58. Zacatecas, Municipality of Guadalupe Victoria: 9-11-1986, M. Torres-Romero, 1 ♂, CZUAA SCO-60. Municipality of Juchipila: 16-04-2016, K. I. Molina, 1 ♂, CZUAA SCO-413; 25-03-2016, E. A. Bernal-Montoya, 1 ♀, CZUAA SCO-425; 15-05-2016, A. Barba, 1 ♂, CZUAA SCO-448. Municipality of Nochistlán: 2-03-2010, E. F. Pulido-Hornedo, 1 ♀, CZUAA SCO-53. Municipality of Tabasco: 10-06-2010, A. Lara, 1 ♂, CZUAA SCO-57. Municipality of Valparaiso: 4-04-2017, S. D. López-González, 1 ♂ CZUAA SCO-416.

Remarks

Known records for *C. infamatus* include the southern half of Aguascalientes, northwestern Guanajuato, Jalisco, Michoacán, and the southern third of Zacatecas (González-Santillán & Possani, 2018). State records without precise locality information were published for Colima, Durango, Nayarit, Oaxaca, Puebla, Querétaro, and Sinaloa (Ponce-Saavedra & Francke, 2013a; Ponce-Saavedra et al., 2022; Santibáñez-López et al., 2015).

Centruroides infamatus is a component of Aguascalientes species richness, and before our work, it was the only species of medical importance reported for the state. This species inhabits the area corresponding to the Trans Mexican Volcanic Belt biogeographic province. However, its distribution in Aguascalientes is restricted to the southwestern municipalities, most abundantly in Calvillo, which corresponds to the lower lands of the Pacific biogeographic province. *Centruroides infamatus* was recorded in high densities in altitudes between 1,700 and 2,100 m on the slopes of a canyon formed by the Sierra del Laurel and Sierra Fría. We hypothesized that as part of the diversification of the *infamatus* species group of the genus *Centruroides* (*sensu* Ponce-Saavedra & Francke, 2019), the populations established in this area of Aguascalientes and most likely in Zacatecas, may represent a separate species from the Trans Mexican Volcanic Belt biogeographic province populations due to their geographical disjunction

created by the Sierra del Laurel to the east and the arid zone corresponding to the Chihuahuan desert, north to the Aguascalientes City. In another scenario, we surmise that this species may be a component of the Pacific Lowlands province that has penetrated the mainland and most likely represents a distinctively independent taxon from the populations inhabiting the Trans Mexican Volcanic Belt. Further molecular and ecological studies may clarify these hypotheses.

Diplocentridae Karsch, 1880
Diplocentrus zacatecanus Hoffmann, 1931 (Fig. 6)

Taxonomic summary

Lectotype: deposited in the CNAN. México: Aguascalientes: Tepezalá (22°13.3629' N, 102°10.0149' W, 2,100 m.), no date or collector 1 ♂ (CNAN-T0761). Paralectotypes: 2 ♂♂ and 1 ♀ (CNAN-T0762) same locality and collection event (Santibáñez-López & Francke, 2013).

Records from literature: Hoffmann (1931): México, Aguascalientes, Municipality of Tepezalá. Zacatecas, Municipality of Pinos. Ponce-Saavedra et al. (2009): México, Aguascalientes, Municipality of Tepezalá: 22°13'20.94" N, 102°10'17.53" W, 2100 m. Durango, Municipality of San Juan de Guadalupe: Loma Alta, 24°37'58.05" N, 102°45'2.80" W, 1,560 m. Vicente Guerrero, 23°43'53.99" N, 103°59'14.55" W, 1,922 m. Estado de México, Municipality of Aculco: La Loma, 20°06'07.03" N, 99°51'25.71" W, 2,450 m. Municipality of Soyaniquilpan: San José Deguedo, 20°05'09.04" N, 99°33'48.78" W, 2,514 m. Guanajuato, Municipality of Coroneo, 20°11'54.81" N, 100°21056.60" W, 2,280 m. Hidalgo, Municipality of Tula de Allende: Michimaloya, 20°05'34.88" N, 99°23'57.93" W, 2,078 m. Michoacán, Municipality of Contepec: 19°57'10.44" N, 100°09'48.90" W, 2,480 m. Querétaro, Municipality of Cadereyta: Cadereyta, 20°41'38.29" N, 99°48'36.21" W, 2037 m. El Organal, 20°37'09.49" N, 99°38'27.98" W, 1,733 m. Vizarrón de Montes, 20°50'03.63" N, 99°43'09.27" W. Municipality of Huimilpan: 20°22'22.23" N, 100°16'27.48" W, 2,288 m. San Luis Potosí, Municipality of Villa de Ramos: 22°49'53.21" N, 101°54'36.01" W, 2,200 m. Zacatecas, Municipality of Cañitas de Felipe Pescador: 23°36'20.10" N, 102°43'47.50" W, 2,027 m. Municipality of Sain Alto: Emiliano Zapata, 23°34'16.66" N, 103°18'02.75" W, 2,067 m. Municipality of Zacatecas: 22°46'19.52" N, 102°34'32.01" W, 2,440 m. Santibáñez-López and Francke (2013): México, Aguascalientes, Municipality of Tepezalá: 22°13'21.77" N, 102°10'00.89" W, 2,100 m, CNAN-T0761, lectotype, 1 ♂; CNAN-T0762, paralectotypes, 2 ♂, 1 ♀; 1 km N, 22°14'20.88" N, 102°10'28.02" W, 2,048 m, 4 ♂, CNAN-S03075, 4-07-2005, O. F. Francke, J. Ponce-Saavedra, M. Córdova, A. Jaimes, G. Francke, V. Capovilla, 2 ♂, AMNH. Zacatecas, Road Sombrerete-Durango: km 179, 23°40'47.88" N, 103°41'42.72" W, 2,448 m, 9-08-2005, O. F. Francke, W. D. Sissom, C. Lee, K. McWest, L. Jarvis, C. Durán, H. Montaño, A. Ballesteros, 3 ♀, CNAN-SC1731; 3 ♀, AMNH.

Examined material: Mexico, Aguascalientes, Municipality of Asientos: Asientos, 10-02-2013, V. Martínez-Salazar, 1 ♀, CZUAA SCO-06; 17-03-2013, C. Franco-Servín de la Mora, 1 ♀, CZUAA SCO-10; 22-02-2013, R. A. Rosales, 1 ♀, CZUAA SCO-12. Municipality of El Llano: Juan el Grande, 21°56'21.00" N, 101°55'06.00" W, 2,495 m, 18-10-2019, N. A. Pulido-Hornedo, X. A. Ruiz, 3 ♀, CZUAA SCO-473; 18-10-2019, F. Chávez-Samayoa, 4 ♂, 6 ♀, CZUAA SCO-475; 21°55'54.55" N, 101°56'09.28" W, 2,117 m, 22-09-2019, F. Chávez-Samayoa, 2 ♂, 4 ♀, CZUAA SCO-490; 21°56'14.57" N, 101°55'24.35" W, 2,285 m, 1-06-2020, P. C. Hernández-Romero, D. F. Simijaca-Salcedo, F. Chávez-Samayoa, 1 ♀, CZUAA SCO-541; 21°56'21.08" N, 101°55'17.87" W, 2,395 m, -10-2019, E. González-Martínez, 1 ♂, 2 ♀, CZUAA SCO-543; 22-01-2021, F. Chávez-Samayoa, A. Palacios, D. F. Simijaca-Salcedo, 1 ♂, CZUAA SCO-633; 21°56'14.57" N, 101°55'24.35" W, 2,284 m, -04-2021, F. Chávez-Samayoa, D. F. Simijaca-Salcedo, 1 ♂, CZUAA SCO-645; -03-2021, F. Chávez-Samayoa, D. M. Reyes-Páramo, 1 ♀, CZUAA SCO-652. Municipality of Tepezalá: Cerro del Capulín, 22°14'45.06" N, 102°09'14.90" W, 2,189 m, 6-10-2019, F. Chávez-Samayoa, I. Villalobos-Juárez, E. González-Martínez, 2 ♂, 2 ♀, CZUAA SCO-488; 13-10-2019, F. Chávez-Samayoa, 5 ♀, CZUAA SCO-505; 22°14'01.00" N, 102°09'27.58" W, 2,130 m, 21-08- 2020, F. Chávez-Samayoa, 2 ♀, CZUAA SCO-525; 30-11-2020, I. Villalobos-Juárez, D. F. Simijaca-Salcedo, F. Chávez-Samayoa, 1 ♀, CZUAA SCO-595; 25-04-2021, F. Chávez-Samayoa, D. F. Simijaca-Salcedo, I. Villalobos-Juárez, 1 ♂, CZUAA SCO-662. Tepezalá, -04-2006, O. Ortega, 1 ♂, CZUAA SCO-01; -03-2006, M. de la Riva, 1 ♂, CZUAA SCO-02; 27-04-2006, L. Reséndiz, 1 ♂, CZUAA SCO-04; -04-2006, R. A. Carbajal, 1 ♀, CZUAA SCO-07; -06-2006, L. Flores, 1 ♀, CZUAA SCO-09; -06-2006, J. Salazar-López, 1 ♀, CZUAA SCO-11; 15-06-2006, E. Medina-Alcantar, 1 ♂, CZUAA SCO-15; 15-06-2006, V. Revilla-Castellanos, 1 ♀, CZUAA SCO-16; 28-02-2006, M. Domínguez-De la Riva, 1 ♀, CZUAA SCO-17; -03-2006, D. Rendón, 1 ♀, CZUAA SCO-18; -05-2006, F. A. Guerras-Roque, 1 ♀, CZUAA SCO-20. San Luis Potosí, Muncipality of San Luis Potosí: Cerro de San Pedro, 7-04-2007, L. Argüello, 1 ♀, CZUAA SCO-449.

Figure 6. Habitus of male (top) and female (bottom) of *D. zacatecanus*, scale = 1 cm.

Remarks

This species is recorded from Aguascalientes, Durango, Estado de México, Guanajuato, Hidalgo, Michoacán, Querétaro, San Luis Potosí, and Zacatecas (Ponce-Saavedra et al., 2009; Santibáñez-López & Francke, 2013).

Formerly a subspecies of *Diplocentrus keyserlingii* Karsch, 1880, it was described by Hoffmann from specimens collected in the Municipality of Tepezalá, Aguascalientes. We confirmed its presence in the type locality Tepezalá and additionally in the Municipalities of El Llano and Asientos. *Diplocentrus zacatecanus* inhabits the portion of the state that belongs to the Chihuahuan Desert biogeographic province (Morrone et al., 2017), which is nearly half of Aguascalientes's surface.

The external morphology and the hemispermatophore of *D. zacatecanus* are either conserved or too variable to

delimit species (Santibáñez-López & Francke, 2013). One possible explanation is the propensity of being substrate specialists and their strong adaptation to construct galleries where they spend most of their life exhibiting scarcely superficial activity. *Diplocentrus zacatecanus* is a substrate specialist requiring a particular type of soil, like other pelophilous species (Polis, 1990; Prendini, 2001). Soil-type discontinuity hinders its dispersal, promoting isolated populations and may promote allopatric speciation. Due to its wide distribution range in Mexico, *D. zacatecanus* may comprise a species complex that needs molecular studies to clarify and guide the correct species delimitation within such a broad distribution area.

Vaejovidae Thorell, 1876
Syntropinae Kraepelin, 1905
Chihuahuanus bilineatus (Pocock, 1989) (Fig. 7)

Taxonomic summary

Holotype: British Museum of Natural History, London, UK: San Diego Texas, USA. 1 ♀. Williams (1970) and Sissom (2000) indicated that this is a spurious locality and is not found in Texas.

Records from literature: Hoffmann (1931): México, Aguascalientes, Municipality of Tepezalá: 20 exemplars (♂, ♀). González-Santillán and Prendini (2013): México, Tamaulipas, Municipality of Jaumave: El Salto, between Palmillas and Jaumave, 23°21'26.39" N, 99°30'56.45" W, 1,115 m, 23-08- 2006, O. F. Francke, W.D. Sissom, G. Casper, T. Anton, V. Torti, H. Montaño, C. Santibáñez, 1 ♂, 1 ♀, CAS(ARA-1883). González-Santillán and Prendini (2015): México, Guanajuato, Municipality of San Luis de la Paz: San Luis de La Paz, 7 km E, 21°18'42.84" N, 100°25'36.06" W, 2,117 m, 24-08-2006, O. F. Francke, W. D. Sissom, G. Casper, T. Anton, V. Torti, H. Montaño, C. Santibáñez, A. Ballesteros, 1 ♀, AMCC (LP 6594). San Luis Potosí, Municipality of Ciudad del Maíz: Puerto Santa Catarina, 22°18'13.38" N, 99°37'16.08" W, 1,214 m, 22-08-2006, O. F. Francke, W. D. Sissom, G. Casper, T. Anton, V. Torti, H. Montaño, C. Santibáñez, A. Ballesteros, 1 ♀, AMCC (LP 6507). Tamaulipas, Municipality of Jaumave: El Salto, between Palmillas and Jaumave, 23°21'26.39" N, 99°30'56.45" W, 1,115 m, 23-08-2006, O.F. Francke, W. D. Sissom, G. Casper, T. Anton, V. Torti, H. Montaño, C. Santibáñez, 1 ♂, 1 ♀, AMNH (ARA 1129). Zacatecas, Municipality of Fresnillo: Colonia Guanajuato, 23°04'44.94" N, 103°05'08.34" W, 2,250 m, 6-07-2005, O. F. Francke, J. Ponce, M. Córdova, A. Jaimes, G. Francke, V. Capovilla, 1 ♀, AMCC (LP 5306). Yahia & Sissom (1996): México, Aguascalientes, Municipality of Asientos: 3.2 km W Asientos, 2,225 m, 9-06-1956, B. Banta, 2 ♂, 1 ♀, 19 juv., AMNH. Muncipality of Tepezalá: Tepezalá, C. C. Hoffmann, 4 ♂, 4 ♀, AMNH. Coahuila, Municipality of Saltillo: 8.6 km W Buñuelos in Valle de Guerra, 15-07-1977, E. A. Liner, Chaney, 2 ♀, FSCA. Nuevo León, Municipality of La Asención: 7.24 km N La Ascension, 19-07-1975, E. A. Liner, 2 ♀, 9 juv., FSCA. 4.34 km N, 3.86 km SE La Ascension on La Caballada Road, 19-07-1975, E. A. Liner et al., 2 ♂, 3 ♀, FSCA. 12.39 km N La Ascension, 19-07-1975, E. A. Liner et al, 2 ♂, 1 ♀, FSCA. 11.1 km W El Carmen, 15-06-1976, E. A. Liner et al., 1 ♀, FSCA. 3 km S San Roberto, under cactus, 13-08-1972, N.V. Horner, 1 ♀, WDS. San Luis Potosí: 35.40 km S Huizache, 20-

Figure 7. Habitus of male (top) and female (bottom) of *C. bilineatus*, scale = 1 cm.

09-1979, J.C., J. E. Cokendolpher, 1 ♂, WDS. km 20 on highway 70, 1 juv, -03-1972, 2 ♀, 1 ♀, AMNH. Hwy 70, 112.65 km W Valles, 19-02-1970, J. A. L. Cooke, R. W. Mitchell, 1 ♂, 2 ♀, 1 juv., AMNH. Municipality of Ciudad de Maíz: near Ciudad del Maíz, 19-08-1947, C. & M. Goodnight, 1 ♀, AMNH; km 50 on Hwy 57, 18-03-1972, J. M. Rowland, TMM 1 ♂. Tamaulipas: Km 14 on Hwy 101, 22-02-1973, W. Graham, T. R. Mollhagen, C. McConnell, 3 ♂, 8 ♀, 2 juv., AMNH. Km 53 on Hwy 101, 23-02-1973, T. R. Mollhagen, 1 ♂ subadult 1 ♀, AMNH. Km 92 on Hwy 101, 22-02-1973, T. R. Mollhagen, 1 ♂, 8 ♀, AMNH. Km 15 on Hwy 19, 18-03-1972, J. A. L. Cooke, 1 ♀, AMNH. Municipality of Ciudad Victoria: Ciudad Victoria, -06-1977, F. D. White, 1 ♀, WDS. 1 km NW La Presita, 20-09-1979, J. C. & J. E. Cokendolpher, 2 ♀, WDS. Palmillas, T. Raines, 2 ♀, AMNH. Municipality of Jaumave: 6.43 km N Jaumave, 20-09-1979, J.C. & J. E. Cokendolpher, 1 ♀, WDS.

Examined material: Mexico, Aguascalientes, Municipality of Asientos: Cerro Altamira, 2015, J. E. Díaz-Plascencia 1 ♀, CZUAA SCO-470. Asientos, 21-06-2015, J. E. Díaz-Plascencia, J. L. Aguilar-Aguilar, 1 ♀, CZUAA SCO-325. Municipality of El Llano: Juan el Grande, 21°56’21.00” N, 101°55’05.99” W, 2,493 m, 18-10-2019, N. A. Pulido-Hornedo, X. A. Ruiz, 5 ♂, 20 ♀, CZUAA SCO-474; 21°56’21.00” N, 101°55’06.00” W, 2,148 m, 8-08-2020, F. Chávez-Samayoa, 1 ♂, CZUAA SCO-524; 21°56’20.00” N, 101° 55’08.90” W, 2,492 m, 20-05-2020, F. Chávez-Samayoa, D. F. Simijaca-Salcedo, 1 ♂, CZUAA SCO-540; 21°56’01.53” N, 101°55’42.29” W, 2,155 m, 25-09-2020, D. F. Simijaca-Salcedo, F. Chávez-Samayoa, 4 ♀, CZUAA SCO-577; 21°56’08.88” N, 101°55’30.72” W, 2,228 m, 22-01-2021, D. F. Simijaca-Salcedo, A. Palacios, F. Chávez-Samayoa, 2 ♀, CZUAA SCO-628; 21°56’21.88” N, 101°55’18.44” W, 2,384 m, -03-2021, F. Chávez-Samayoa, D. M. Reyes-Páramo, 2 ♂, 1 ♀, CZUAA SCO-648. Municipality of Tepezalá: Cerro del Capulín, 22°14’45.06” N, 102° 09’14.90” W, 2,189 m, 13-10-2019, F. Chávez-Samayoa, I. Villalobos-Juárez, 15 ♂, 16 ♀, CZUAA SCO-494; 22°14’19.46” N, 102° 09’58.03” W, 2,082 m, 31-05-2020, F. Chávez-Samayoa, D. F. Simijaca-Salcedo, I. Villalobos-Juárez, 1 ♂, CZUAA SCO-520; 22°14’01.00” N, 102°09’27.58” W, 2,129 m, 21-08-2020, F. Chávez-Samayoa, 4 ♀, CZUAA SCO-527; 22°13’52.88” N, 102°09’36.76” W, 2,125 m, 23-10-2020, F. Chávez-Samayoa, I. Villalobos-Juárez, I. E. Gallegos-Vieyra, D. F. Simijaca-Salcedo, 1 ♀, CZUAA SCO-575. Cerro de San Juan, ladera N, 8-10-1988, J. A. Rodríguez-Ávalos, 3 ♀, CZUAA SCO-305. Tepezalá, 22°13’54.26” N, 102°10’03.06” W, 2,116 m, 7-08-2015, M. Rodríguez, CNAN; Tepezalá, 15-06-2006, V. Revillo-Castellanos, 1 ♀, CZUAA SCO-301; 28-03-2006, Z. Y. González-Saucedo, 1 ♀, CZUAA SCO-302. Nuevo León, Municipality of Galeana: 2 km hacia mina “La Huiche”, 24°41’33.72” N, 100°03’19.91” W, 1,945 m, 28-09-2013, O. F. Francke, A. Valdez, D. Barrales, J. Cruz, A. Guzmán, CNAN-SC003911. Zacatecas, Municipality of Luis Moya: Griegos community, 15-11-1996, J. R. Treviño, 1 ♀, CZUAA SCO-303.

Remarks

Chihuahuanus bilineatus is distributed in Aguascalientes, Coahuila, Guanajuato, Nuevo León, San Luis Potosí, and Tamaulipas (Sissom, 2000; Yahia & Sissom, 1996). This species was reported for the first time in Aguascalientes by Hoffmann (1931) for the Municipality of Tepezalá. This species has an affinity for arid environments and could be classified as a lapidicolous species (González-Santillán & Prendini, 2013). It also inhabits mainly the Chihuahuan Desert province, and collection records in the state include the municipalities of Aguascalientes, Asientos, El Llano, Jesús Maria, and Tepezalá.

Chihuahuanus coahuilae (Williams, 1968) (Fig. 8)

Taxonomic summary

Holotype: California Academy of Sciences: Mexico: Coahuila: 0.5 km SW Cuatro Ciénegas de Carranza, 1 ♂ and 19 ♂♂, 25 ♀♀ paratypes (type No. 10170).

Records from literature: González-Santillán and Prendini (2013): México, Coahuila, Municipality of Cuatro Ciénegas: Ojo de Agua, ejido El Oso, 27°00’03.35” N, 102°00’13.57” W, 1,039 m, 19-07-2006, O. F. Francke, W. D. Sissom, K. McWest, B. Hendrixson, S. Grant, A. Jaimes, M. Córdova, 2 ♂, 2 ♀, CNAN-T84). González-Santillán and Prendini (2015): Mexico, Coahuila, Municipality of Cuatro Ciénegas: Ojo de Agua, Ejido el Oso, 27°00’03.35” N, 102°00’13.57” W, 1,039 m, 19-07-2006, O. F. Francke, W. D. Sissom, K. McWest, B. Hendrixson, S. Grant, A. Jaimes, M. Córdova, 2 ♂, 2 ♀, AMNH (ARA 1120); 19-07-2006, O. F. Francke, W. D. Sissom, K. McWest, B. Hendrixson, S. Grant, A. Jaimes, M. Córdova, E. González, A. Ballesteros, 1 ♂, AMCC(LP6600). Durango, Municipality of Gómez Palacio: Dinamita, 25°44’05.34” N, 103°40’24.00” W, 1,328 m, 29-07-2005, O. F. Francke, H. Montaño, J. Ballesteros, C. Durán, 1 ♂, AMCC (LP 5353). USA, New Mexico, Luna County: Little Florida Mountains, 1.6 km SE on Bonita Road from turnoff of Gap Road, 32°09’29.4” N, 107°35’18.9” W, 1,761 m, L. Prendini, J. Huff, 1 juv., AMCC(LP7095). McWest et al. (2017): USA; Texas, Armstrong County: SE Claude, Palo Duro Canyon, Mulberry Creek arm, S side of Mulberry Creek, 12.8 km

Figure 8. Habitus of male (top) and female (bottom) of *C. coahuilae*, scale = 1 cm.

S junction US 287/FM 28889, 34°57'01.01" N, 101°13'32.99" W, 11-06-2004, 3 ♂, 1 juv., WTAMU. Tx 207, 23.9 km S US 87, 34°53'42.40" N, 101°22'06.71" W, 1-09-2000, 1 ♀, WTAMU. Briscoe County: Caprock Canyons State Park, 34°26'40.78" N, 101°04'34.54" W, 1 ♂ 3 ♀, WTAMU. Lake Mackenzie, 34°32'40.49" N, 101°26'25.55" W, 14-10-1996, 1 ♀, WTAMU; 16-09-1998, 4 ♀ 4 juv., WTAMU. Tx 256, 22.2 km SW of South Brice, 34°31'28.20" N, 101°00'08.64" W, 739 m, 24-07-2009, 4 ♂, WTAMU. 32.1 km SW of South Brice, 34°28'20.57" N, 101°05'11.04 W, 818 m, 24-06-2009, 1 ♀, WTAMU. Cottle County: Matador Wildlife Management Area, 34°07'09.01" N, 100°27'10.01" W, 1 ♂, WTAMU; Matador WMA, Headquarters Pasture, 34°07'00.16" N, 100°21'32.98" W, ?-05~09-2009, 4 ♂ 3 ♀, 1 juv., WTAMU. Crosby County: White River Lake,

33°27’33.48” N, 101°05’28.61” W (approximate), 23-09-1973, 1 ♀, AMNH; White River Lake, 12-04-1985, Taylor, S. W., SAS. Dickens-Crosby County line: FM 2794, 33°28’09.34” N, 101°02’19.79” W, 26-09-2009, 3 ♂ 3 ♀, 1 juv. ♀, WTAMU. Garza County: Post, 33°11’27.20” N, 101°22’41.56” W (approximate), 11-04-1983, 2 ♀ (one with juveniles), AMNH. 1.6 km S Justiceburg, 33°01’47.53” N, 101°11’41.82” W (approximate), 10-06-1984, 1 ♂, SAS. Justiceburg, 33°02’34.30” N, 101°12’10.44” W (approximate), 16-09-1975, 1 ♂, AMNH. FM 2458, 1.1 km E jct US 84, 33°02’58.67” N, 101°11’43.08” W, 26-09-2009, 6 ♂ 3 ♀, WTAMU; FM 2458, 1.4~1.7 km E jct US 84, 26-09-2009, 3 ♂ 5 ♀, WTAMU; FM2458, 2.2 km E jct US 84, 33°02’46.00” N, 101°10’58.01” W, 26-09-2009, 3 ♀, WTAMU; jct FM 2458 and FM 3519, 33°02’46.46” N, 101°09’37.51” W, 26-09-2009, 3 ♂ 4 ♀, WTAMU. Hall County: N Estelline, sand dunes along S side of Red River at US 287, 34°33’38.30” N, 100°26’33.83” W, 545 m, 19-09-1996, 2 ♂ 1 ♀, WTAMU. Turkey, 34°23’33.18” N, 100°53’51.54” W (approximate), 18-06-1970, 1 ♀, AMNH. TX 70/256, 34°40’17.15” N, 100°55’25.68” W, 650 m, 24-07-2009, 8 ♂ 2 ♀, WTAMU; TX 70/256 6.4 km SW South Brice, 34°38’44.88” N, 100°55’52.90” W, 658 m, 24-07-2009, 2 ♂, WTAMU. King County: Outskirts, E side of Guthrie, 33°37’01.31” N, 100°18’58.32” W, -10-2006, 6 ♂ 22 ♀ 1 juv., WTAMU. Lubbock County: Yellowhouse Canyon, 33°37’33.67” N, 101°53’05.64” W (approximate), 26-04-1973, 1 ♂, AMNH. Motley County: Starkey Ranch, 3.2 km W and 1.6 km S Flomot, 34°12’40.93” N, 101°01’27.62” W (approximate), 19-09-1996, 1 ♂ 3 ♀, WTAMU. 6.4 km NW Matador, 34°03’35.71” N, 100°52’00.88” W (approximate), 11-06-1979, 1 ♀, AMNH. Oldham County: Dirt road off US 385, on grade edge, SE of Canadian River, S Boys Ranch, 35°31’16.64” N, 102°15’26.03” W, 07-04-1996, 1 juv., WTAMU. FM 1061, 7.5 km E jct US 385, 35°28’39.00” N, 102°11’03.98” W, 14-08-1999, 1 ♂, WTAMU. Potter County: Crossbar ranch, E-facing slope above W Amarillo Creek, 35°25’14.99” N, 101°54’38.99” W, 1 subadult ♂, WTAMU. Randall County: Amarillo (south side), 35°09’30.46” N, 101°53’26.81” W (approximate), 07-07-1998, 1 ♀ 1 juv. ♀, WTAMU. Canyon, 34°58’49.04” N, 101°55’07.50” W (approximate), 04-02-1968, 1 juv., WTAMU. RR 1541, 35°01’57.58” N, 101°50’51.65 W, 1,053 m, 24-06-2009, 6 ♂ 1 ♀, WTAMU. Ceta Canyon, 27-09-1998, 1 ♀, WTAMU. FM 1541, N side of Palo Duro Creek bridge, 35°01’58.55” N, 101°50’51.29” W, 1,055 m, 14-10-2005, 1 ♂ 1 juv. ♂, WTAMU. About 11.2 km NE Canyon, FM 1541, S side of canyon at Palo Duro Creek, 35°01’53.29” N, 101°50’53.63” W, 01-08-1997, 1 ♂, WTAMU. Lake Tanglewood, 35°03’24.19” N, 101°46’11.57” W, 26-09-2006, 2 ♂ 7 ♀ 2 juv., WTAMU, 35°02’37.43” N, 101°45’31.57” W, 08-07-2002, 2 ♂, WTAMU; 35°03’10.01” N, 101°45’07.99” W, 11-07-2002, 1 ♂, WTAMU; 35°02’26.40” N, 101°45’56.04” W, 11-07-2002, 2 ♂, WTAMU; 35°03’11.23” N, 101°45’16.49” W, 08-07-2002, 2 ♂, WTAMU; 35°03’08.89” N, 101°45’35.10” W, 08-07-2002, 1 ♂, WTAMU. Palo Duro Canyon State Park, 34°56’01.39” N, 101°38’34.58” W, 05-06-1996, 1 ♂, WTAMU; 34°55’56.21” N, 101°38’05.89” W, 05-06-1996, 2 ♂ 3 ♀ 1 subadult ♀, WTAMU. Tangle Aire Estates, 35°04’05.12” N, 101°47’49.49” W, 22-10-1998, 1 ♀, WTAMU. Timbercreek Canyon, 19.3 km NE Canyon, 14-10-1998, 2 juv, WTAMU, 35°02’54.49” N, 101°49’41.41” W, 24-09-2006, 3 ♂ 22 ♀ 2 juv., WTAMU. Scurry County: 11.7 km W Ira, 32°35’54.67” N, 101°07’08.65” W (approximate), 21-04-1979, 1 ♀ 2 juv., WDS. Yoakum County: Plains, Co. Rd 230, about 0.8 km S jct US 82/US 380, 33°10’49.62” N, 102°50’09.28” W, 17-07-2009, 1 ♂ 1 ♀, WTAMU; Co. Rd 230, about 2.5 km S Plains, jct US 82/US 380, 33°10’04.08” N, 102°50’21.16” W, 17-07-2009, 1 ♀, WTAMU. Santibáñez-López et al. (2019): México, Zacatecas, Municipality of Concepción del Oro: Anahuac, 24°31’51.60” N, 101°19’09.12” W, -04-2015, H. Carmona. Stockwell (1986): México, Coahuila, Municipality of Cuatro Ciénegas: 0.5 km SW of Cuatro Ciénegas de Carranza, 28-07-1967, S. C. Williams, W. S. Brown, 1 ♂ paratype 1 ♀ paratype, AMNH. 1.6 km S of Cuatro Ciénegas de Carranza, 12-08-1968, M. A. Cazier, J. Bigelow, 1 ♂ 1 ♀, AMNH. Cuatro Ciénegas Basin, 22-04-1973, J. Landy, 1 ♀, AMNH. USA, Arizona, Cochise County: Peloncillo mountains., 4-08-1976, M. A. Cazier, J. Hubbard, 1 ♂, AMNH. New Mexico, Bernardillo County: 5 km W of Albuquerque, 9-08-1981, R. A. Bradley, 1 ♀, AMNH; 2-09-1981, R. A. Bradley, 2 ♀, AMNH. Dona Ana County: 32.1 km N of Las Cruces, 31-05-1970, R. Smith, 6 ♂, 7 ♀, AMNH; Las Cruces, 28-05-1970, R. Smith, 3 ♂, AMNH; 16.09 km. S of Las Cruces, 15-05-1970, R. Smith, 3 ♂, AMNH. Eddy County: Guadalupe Mts., 1 ♀, AMNH. Carlsbad Caverns National Park, 6-10-1976, V. Roth, 1 ♂, AMNH. 24.14 km E of Loving, Summer 1978, C. Rudolf, 3 ♂ 6 ♀, AMNH. Hidalgo County: 1.6 km N of Rodeo, 20-07-1976, J. Hubbard, M. A. Cazier, 21 juv., AMNH; 25-07-1976, J. Hubbard, M. A. Cazier, 2 ♂, 2 ♀, AMNH. Lincoln County: Valley of Fires State Park, 19-06-1974, L. Draper, M. A. Cazier, O. F. Francke, 1 ♂, AMNH. Luna County: 17.70 km E of Deming, J. Bigelow, 1 ♀, AMNH. Valencia County: 32.83 km NW of Los Lunas, 17-06-1970, M. A. Cazier, et al., 1 ♀, AMNH. Texas, Brewster County: Alpine, 2-10-1955, H. L Stahnke,

2 ♂, CAS; 7-10-1964, J. Scudday, 1 ♀, CAS. 4 km S of Alpine, 19-08-1968, S. C. Williams, J. Bigelow, M. M. Bentzien, 1 ♀, 7 ♂, CAS. 35.4 km S of Alpine (Babcock Ranch), 25-04-1964, S. Sikes, 1 ♀, CAS; 26-04-1964, S. Sikes, 1 ♂, CAS. Marathon, 20-07-1956, H. L. Stahnke, 1 ♂, CAS. 41.8 km S of Alpine, 28-07-1978, O. F. Francke, J. V. Moody, 1 ♀, AMNH. 12.87 km NE of Marathon, 27-07-1978, O. F. Francke, J. V. Moody, 1 ♂, AMNH; Big Bend National Park, 4-05-1966, E. Lehnert, 1 ♀, CAS. Big Bend National Park, Grapevine Hills, 18-08-1968, S. C. Williams, 2 ♀, CAS. Big Bend National Park, N base of Grapevine Mt., 7-09-1969, M. A. Cazier, et al., 35 ♂ 25 ♀, AMNH. Big Bend National Park, Burrow Spring Road, 22-03-1986, S. A. Stockwell, J. M. Steele, 1 ♀, CAS. Big Bend National Park, K-Bar Ranch, 25-07-1972, R. C. Stephens, 1 ♀, UCLB. Big Bend National Park, Panther Jct., 23-07-1956, H. L. Stahnke, 1 ♂, CAS. Big Bend National Park, Panther Jct., 17-08-1968, S. C. Williams, M. M. Bentzien, 29 ♀ 39 ♂, CAS; Big Bend National Park, 19.31 km SE of Panther Jct., 17-08-1968, S. C. Williams, M. M. Bentzien, 1 ♀, CAS. Big Bend National Park, 21.24 km SE of Panther Jct., 17-08-1968, S. C. Williams, M. M. Bentzien, 2 ♀, CAS. Big Bend National Park, Basin Jct., 17-08-1968, M. A. Cazier, J. Bigelow, 2 ♀ 5 ♂, CAS. Big Bend National Park, Rio Grande Village, 21-06-1970, M. A. Cazier, L. Welch, O. F. Francke, 27 ♂, 24, ♀, AMNH; 16-06-1974, M. A. Cazier, O. F. Francke, 19 ♂, 9 ♀, AMNH; -07-1978, 1 ♀, AMNH; 29-07-1978, O. F. Francke, J. V. Moody, 1 ♂, 1 ♀, AMNH. Big Bend National Park, 27-01-1973, C. McConnell, 1 ♂, AMNH. Crocket County: 16.09 km N of Iraan, 15-09-1985 S. A. Stockwell, 7 ♀, 1 ♂, SAS; 17.7 km N of Iraan, 29-09-1985, S. A. Stockwell, 1 ♀, SAS. 16.1 km N of Iraan, 8-03-1986, S. A. Stockwell, 3 ♀, SAS. 24.1 km S of Rankin, 21-03-1978, O. F. Francke, J. V. Moody, Hall, 1 ♂, 1 ♀, AMNH. Crosby County: White River Lake, 23-09-1973, J. M. Rowland, 1 ♀, AMNH; 12-04-1985, S. W. Taber, 1 ♀, 1 ♂, SAS. Bar X Ranch, 17-09-1977, O. F. Francke, J. R. Reddell, F. W. Wagner, 1 ♀, AMNH. Culberson County: Guadalupe Mts. National Park, McKittrick Canyon, 14-05-1978, O. F. Francke, J. V. Moody, 2 ♂, AMNH. Guadalupe Mts., Pine Springs Canyon, 18-06-1974, M. A. Cazier, O. F. Francke, 4 ♂, 1 ♀, AMNH. Guadalupe Mts., 5.6 km S of Pine Springs, 3-09-1972, O. F. Francke, J. Davidson, 2 ♂, AMNH. Guadalupe Mts., 12.07 km S of Pine Springs, 3-09-1972, O. F. Francke, J. Davidson, 1 ♂, AMNH. Guadalupe Mts. foothills below El Capitan, 30-08-1969, W. S. Parker, 1 ♀, CAS. Kent, 23-07-1956, H. L. Stahnke, 1 ♀, CAS; 1.6 km N of Kent, 23-06-1970, M. A. Cazier, L. Welch, O. F. Francke, 4 ♂, 6 ♀, AMNH. 6.4 km NE of Kent, 14-03-1981, N. V. Horner, 1 ♀, 1 ♂, MWSU. 125.5 km NE of Van Horn, 6-07-1979, O. F. Francke, J. V. Moody, Merikel, 1 ♀, AMNH. 31.38 km NE of Van Horn, 2-06-1978, O. F. Francke, J. V. Moody, Hall, 1 ♂, 1 ♀, AMNH. Van Horn, 28-06-1964, M. H. Muma, 1 ♂, CAS. El Paso County: Anthony, 19-06-1970, M. A. Cazier, L. Welch, O. F. Francke, 1 ♂, 1 ♀, AMNH; Franklin Mts., 19-05-1978, O. F. Francke, J. V. Moody, 1 ♂, AMNH; Franklin Mts. McKelligan Canyon Park, 13-04-1969, W. S. Parker, 1 ♂, CAS, 22-06-1969, W. S. Parker, 4 ♂, CAS, 12-07-1969, W. S. Parker, 1 ♀ 1 ♂, CAS. Garza County: Post, 11-04-1983, F. Rose, 1 ♂ 1 ♀ with young, AMNH; Justiceburg, 16-09-1975, Webb, 1 ♂, AMNH; 1.6 km mi. S of Justiceburg, 10-06-1984, S. A. Stockwell, 1 ♂, SAS. Hall County: Turkey, 18-06-1970, D. Kiser, 1 ♀, AMNH. Hudspeth County: 57.9 km E of El Paso, 15-03-1986, S. A. Stockwell, J. M. Steele, 1 ♀, SAS. 9.6 km E of Salt Flat, 8-09-1972, O. F. Francke, J. Davidson, 1 ♀, AMNH. 9.6 km E of Hueco, 5-06-1974, L. Draper, M. A. Cazier, O. F. Francke, 5 ♂, 4 ♀, AMNH. 22.5 km N of Sierra Blanca, 21-05-1978, O. F. Francke, J. V. Moody, 1 ♀, AMNH. 4.5 km S of Sierra Blanca, 21-05-1978, O. F. Francke, J. V. Moody, 1 ♂, 3 ♀, AMNH. Jeff Davis County: 16.1 km S of Kent, 18-04-1980, W. W. Dalquest, 1 ♀, MWSU. 20 km S of Toyahvale, 13-03-1977, J. C. Cokendolpher, 1 ♂, MWSU. 40.1 km S of Van Horn, 3-06-1978, O. F. Francke, J. V. Moody, Hall, 3 ♀, AMNH. 50.4 km S of Van Horn, 2-06-1978, O. F. Francke, J. V: Moody, Hall, 1 ♂, AMNH. 6.4 km W of Fort Davis, 6-06-1978, O. F. Francke, Hall, J. V. Moody, 2 ♀, AMNH. Fort Davis, 7-06-1978, O. F. Francke, J. V. Moody, Hall, 2 ♀, AMNH. Fort Davis National Park, 11-09-1963, “Staff”, 1 ♀, 1 ♂, CAS. Davis Mts. State Park, 20-06-1970, M. A. Cazier, L. Welch, O. F. Francke, 3 ♀, AMNH; 20-08-1974, J. V. Moody, 1 ♂, 1 ♀, AMNH; Davis Mts. State Park Limpia Canyon, 5-06-1974, L. Draper, M. A. Cazier, O. F. Francke, 3 ♀, AMNH. Loving County: 12.9 km N of Mentone, 1-06-1978, O. F. Francke, J. V. Moody, Hall, 1 ♀, AMNH. Lubbock County: Yellowhouse Canyon, 26-04-1973, T. R. Mollhagen, 1 ♂, AMNH. Motley County: 6.4 km NW of Matador, 11-06-1979, O. F. Francke, J. V. Moody, W. D. Sissom, 1 ♀, AMNH. Pecos County: 16.1 km N of Ft. Stockton, Will Banks Ranch, 27-12-1966, R. Winokur, 2 ♀ paratypes, CAS. 6.4 km E of Sheffield, along Pecos River, 7-06-1974, M. A. Cazier, L. Draper, O. F. Francke, 7 ♂, 5 ♀, AMNH. Presidio County: 76.6 km N of Candelaria, 3-06-1978, O. F. Francke, J. V. Moody, Hall, 1 ♀, AMNH. Candelaria, 14-06-1977, R. Wilson, 3 ♀, 1 ♂, CAS; R. Wilson, 2 ♀, 5 ♂, one ♀ with 40 first instar young, CAS; 29-07-1977, R. Wilson, 4 ♀ 1 ♂, CAS; 14-08-1977, R. Wilson, 3 ♀, 2 ♂, CAS; 23-08-1977, R. Wilson, 3 ♀, CAS; 26-09-1977, R. Wilson, 2 ♂, CAS.

61.1 km NE of Presidio, 5-06-1978, O. F. Francke, J. V. Moody, Hall, 1 ♂, 2 ♀, AMNH. 49.8 km NE of Presidio, 5-06-1978, O. F. Francke, J. V. Moody, Hall, 2 ♀, AMNH. 5.3 km N of Presidio, 2-09-1972, O. F. Francke, J. Davidson, 2 ♂, AMNH. 53.1 km S of Marfa, 5-06-1978, O. F. Francke, J. V. Moody, Hall, 2 ♂, AMNH. 0.8 km N of Shafter, 2-09-1972, O. F. Francke, J. Davidson, 3 ♂ 4 ♀, AMNH. Reeves County: Pecos, 13-07-1973, J. J. Landye, 1 ♀, AMNH. Balmorhea State Park, 26-08-1971, K. M., M. A. Cazier, 4 ♂ 1 ♀, AMNH. Terrel County: 30.6 km S of Sheffield, 8-06-1974, O. F. Francke, 1 ♂, AMNH. 8 km W of Sanderson, 8-06-1974, L. Draper, M. A. Cazier, O. F. Francke, 3 ♀, AMNH. 40.2 km N of Dryden, 28-07-1970, R. C. Stephens, 1 ♂, UCLB. 12.8 km N of Dryden, 21-10-1978, J. V. Moody, Meeks, 1 ♀, AMNH. Val Verde County: 1.6 km SE of Langtry, 7-06-1974, L. Draper, M. A. Cazier, O. F. Francke, 6 ♂, 7 ♀, AMNH. Wrinkler County: 9.6 km N of Winkler, 1-06-1978, O. F. Francke, J. V. Moody, Hall, 2 ♀, AMNH. 20.9 km S of Kermit, 7-06-1979, O. F. Francke, 1 ♂, AMNH. Williams (1968): México, Coahuila, Cuatro Ciénegas Municipality: Laguna Tio Candido, 14 km S of Cuatro Ciénegas, 15-04-1965, W. L. Minckley, 2 ♀, CAS. Laguna Churince, 16 km S of Cuatro Ciénegas, 24-12-1965, W. L. Minckley, C. O. Minckley, 3 ♀, CAS. Town of Cuatro Ciénegas, 05-04-1967, L. E. Cullum, 3 ♀, CAS. 4 km E of Cuatro Ciénegas, 27-07-1967, S. C. Williams, W. S. Brown, 10 ♂ 17 ♀, CAS. Poza la Becerra, 14 km SW of Cuatro Ciénegas, 28-07-1967, S. C. Williams, W. S. Brown, 2 ♂ 1 ♀, CAS. Gypsum sand dunes, 13 km SW of Cuatro Ciénegas, 27-07-1967, S. C. Williams, W. S. Brown, 2 ♂ 2 ♀, CAS. Travertine Ridge, 12 km SW of Cuatro Ciénegas, 15-08-1967, W. L. Minckley, 1 ♀, CAS. Above Rio Cañon, 4.3 km NW of Cuatro Ciénegas, 15-08-1967, W. L. Minckley, 1 ♂, 2 ♀. USA, Texas, Pecos County: Will Banks Ranch, 16 km N of Fort Stockton, 27-12-1966, R. Winkour, 1 ♂, 1 ♀, CAS.

Examined material: Mexico, Aguascalientes, Municipality of Aguascaientes: El Chicalote, 22°00’43.26” N, 102°15’11.84” W, 1,895 m, -10-2019, D. A. Perales-Olivares, 1 ♂, 1 ♀, CZUAA SCO-504. Universidad Autónoma de Aguascalientes, edificio 132, 28-06-2022, M. Martínez, 1 ♂, CZUAA SCO-673. Cerro de Los Gallos, -04-2015, C. A. Franco-Servín de la Mora, 1 ♂, CZUAA SCO-321. Area NO de la ciudad, 15-06-2006, M. A. López, 1 ♀, CZUAA SCO-322. Municipality of Asientos: Cerro Altamira., 2015, J. E, Díaz-Plascencia, 1 ♂, CZUAA SCO-404. Ojo de Agua de los Sauces, 25-04-2016, G. S. García-Macias, 1 ♂, CZUAA SCO-433. Municipality of Cosío: Estación de Adames, 16-08-2016, I. Chávez, 1♀, CZUAA SCO-412. Municipality of El Llano: Juan el Grande, 21°56’21.00” N, 101°55’06.00” W, 18-10-2019, F. Chávez-Samayoa, 1 ♀, CZUAA SCO-553. Municipality of Jesús María: Los Arquitos, 21°55’21.68” N, 102°23’17.92” W, 1,931 m, 5-09- 2019, F. Chávez-Samayoa, I. Villalobos-Juárez, 1 ♀, CZUAA SCO-486; 21°55’11.50” N, 102°23’26.02” W, 2,014 m, 23-01-2021, F. Chávez-Samayoa, D. F. Simijaca-Salcedo; 1 ♀, CZUAA SCO-617, 26-03-2021, F. Chávez-Samayoa, D. F. Simijaca-Salcedo, 1 ♀, CZUAA SCO-653. Municipality of Tepezalá: Cerro del Capulín, 22°14’01.00” N, 102°09’27.58” W, 2,129 m, 21-08- 2020, F. Chávez-Samayoa, 1 ♂, 1 ♀ juv., CZUAA SCO-526, 23-10-2020, F. Chávez-Samayoa, I. Villalobos-Juárez, I. E. Gallegos-Vieyra, D. F. Simijaca-Salcedo, 1 ♂, CZUAA SCO-573; 22°13’57.46” N, 102°09’40.41” W, 2,119 m, 26-09-2020, F. Chávez-Samayoa, I. Villalobos-Juárez, 1 ♂, CZUAA SCO-582; 22°14’30.30” N, 102°09’13.93” W, 2,184 m, 31-05-2020, F. Chávez-Samayoa, I. Villalobos-Juárez, P. C. Hernández-Romero, D. F. Simijaca-Salcedo, 1 ♀, CZUAA SCO-584; 22°13’54.26” N, 102°10’03.06” W, 2,116 m, 7-08-2015, M. Rodríguez, CNAN. Coahuila, Municipality of Cuatro Ciénegas: Ejido el Oso, 27°03’35.64” N, 102°13’34.90” W, 1,039 m, O.F. Francke et al., 5 ♂, CNANSC2437.

Remarks

Chihuahuanus coahuilae (Williams, 1968) is distributed in Aguascalientes, Chihuahua, Coahuila, and Durango (Sissom, 2000) and in the USA in Texas and New Mexico (Sissom & Hendrixson, 2005; Stockwell, 1986).

Although Escoto-Rocha & Delgado-Zaldívar (2008) reported *Chihuahuanus coahuilae* for the first time in Aguascalientes, subsequent national and regional scale studies (Francke, 2019; Ponce-Saavedra & Francke, 2013b; Santibáñez-López et al., 2015) fail to enlist this species as a part of Aguascalientes scorpion richness. Herein, we confirm the presence of *C. coahuilae* in the municipalities of Aguascalientes, Asientos, El Llano, Jesús María, and Tepezalá. *Chihuahuanus coahuilae* is a lapidicolous species that prefers arid environments within the Chihuahuan Desert province. We observed during fieldwork *C. coahuilae* in sympatry with *D. zacatecanus*, *C. bilineatus*, *C. glabrimanus* Sissom & Hendrixson, 2005, *M. spadix*, *P. gracilior*, and *Vaejovis aguazarca* Díaz-Plascencia & González-Santillán, 2022. Interestingly, no buthid scorpion was sympatric with *C. coahuilae* in Aguascalientes, suggesting a distinctive transition between scorpion faunas. The current distribution of the scorpion fauna established in Aguascalientes can be correlated to the geological history that created the interdigitation between the Sierra Madre Occidental, Pacific lowlands, and the Chihuahuan Desert biogeographic provinces.

Figure 9. Habitus of male (top) and female (bottom) of *C. glabrimanus*, scale = 1 cm.

Chihuahuanus glabrimanus (Sissom & Hendrixson, 2005) (Fig. 9)

Taxonomic summary

Holotype: Florida State Collection of Arthropods, Gainesville, Florida, USA. México, Nuevo Léon: 7.8 km N La Ascension, 24°19'0.00" N, 99°54'00.00" W, 18-07-1972, E.A. Liner, R. M. Johnson, A. H. Chaney, 1 adult ♂. Paratype Mexico, Coahuila: 10.8 km S, 0.16 km E Arteaga at Los Pinos, 25°17'00.00" N, 100°50'00.00" W, 17-09-1975, leg. E.A. Liner et al.

Records from literature: González-Santillán and Prendini (2013): Mexico, Guanajuato, Municipality of San Diego de la Union: San Diego de la Unión, 8 km S, 21°23'08.67" N, 100°53'27.14" W, 2,078 m, 28-07-2006, E. González, M. Córdova, A. Jaimes, A. Ballesteros, O. F. Francke, 1 ♂, AMNH. San Luis Potosí, Municipality of Villa de Arista: Villa de Arista, 10 km E, 22°30'45.65" N, 100°45'29.99" W, 30-08-2006, O. F. Francke, W. D. Sissom, G. Casper, T. Anton, V. Torti, H. Montaño, C. Santibáñez, A. Ballesteros, 4 ♂ 1 ♀, CAS (ARA1909). González-Santillán and Prendini (2015): México, Guanajuato, Municipality of San Diego de la Unión: San Diego de la Unión, 8 km S, 21°23'08.64" N, 100°53'27.12" W, 2078 m, 28-07-2006, O. F. Francke, M. Córdova, A. Jaimes, E. González, A. Ballesteros, 1 juv. AMCC (LP 6611). Nuevo León, Municipality of Galeana: Providencia, 3 km E, 25°08'39.06" N, 100°39'02.40" W, 1,980 m, 17-07-2006, O. F. Francke, E. González, M.

Córdova, J. Ballesteros, A. Jaimes, 1 ♂, AMCC (LP6558). San Luis Potosí, Muncipality of Ciudad del Maíz: Puerto Santa Catarina, 22°18’13.38” N, 99°37’16.08” W, 1,214 m, 22-08-2006, O. F. Francke, W. D. Sissom, G. Casper, T. Anton, V. Torti, H. Montaño, C. Santibáñez, A. Ballesteros, 1 juv, AMCC (LP6610).

Examined material: Mexico, Aguascalientes, Municipality of Aguascalientes: Jardín Botánico Rey Netzahualcoyotl, 10-08-2004, V., 1 ♂, CZUAA SCO-172; 8-06-, G. García, 1 ♂, CZUAA SCO-178; 8-01-2004, J. Escoto, 1 ♀, CZUAA SCO-180; 27-06-2015, J. E. Díaz-Plascencia, 1 ♂, 1 ♀, CZUAA SCO-183. Universidad Autónoma de Aguascalientes, edificio 1 A, 13-10-2015, M. Croce-Hernández, 1 ♀, CZUAA SCO-373; edificio 132, 28-08-2019, I. Villalobos-Juárez, 1 ♂, CZUAA SCO-469; 23-06-2015, G. De la Riva-Hernández, 1 ♀, CZUAA SCO-181; 21-09-2017, M. Martínez, 1 ♂, 1 ♀, CZUAA SCO-438. Avenida Circunvalación lado E, 24-11-1985, O. Rosales-Carrillo, 1 ♀, CZUAA SCO-170. Fraccionamiento Asturias, 18-12-2002, J. A. Escoto-Moreno, 1 ♂, CZUAA SCO-175. Carretera Aguascalientes-San Luis Potosí km 2.5, 15-08-2004, J. A. Escoto-Moreno, 1 ♂, 1 ♀, CZUAA SCO-171. Los Pericos, 29-05-2000, V. Herrera, 1 ♀, CZUAA SCO-165; 28-05-2000, R. M. Morales-Contreras, 1 ♀, CZUAA SCO-169. Rancho El Cocuyo, 23-10-1993, L. Delgado-Saldívar, 1 ♀, CZUAA SCO-173. Centro de Salud Urbano, colonia Guadalupe Peralta, 15-06- 2023, I. Martínez, 2 ♂, CZUAA SCO-734. Municipality of Asientos: Francisco Villa, hogar particular, 22°05’19.00” N, 101°58’05.00” W, 15-10-2002, F. Aguinaga, CNAN-SC4043. Municipality of Calvillo: Cercano a balneario “La Cueva”, 21°49’57.00” N, 102°48’58.82” W, 15-10-2019, F. Chávez-Samayoa, 1 ♀, CZUAA SCO-560. Presa Malpaso, 10-09-1985, C. Ortiz-de L., 1 ♀, CZUAA SCO-164; 1 ♀, 26-09-1993, J. M. González-Martínez CZUAA SCO-174. Municipality of Cosío: Soledad de Abajo, unidad médica, 25-10-2002, F. Aguinaga, CNAN-SC4044. Casa del centro, 1-01-2002, F. Aguinaga, CNAN-SC4045. Municipality of El Llano: Juan el Grande, 21°55’58.40” N, 101°55’42.49” W, 2,198 m, 8-08-2020, F. Chávez-Samayoa, 1 ♂, CZUAA SCO-523. Municipality of Jesús María: Los Arquitos, 21°55’21.68” N, 102°23’17.92” W, 4-09-2019, I. Villalobos-Juárez, F. Chávez-Samayoa, 1 ♀, CZUAA SCO-559. Buenavista, 11-06-2000, R. M. Muñoz, 1 ♂, CZUAA SCO-179. Municipality of Pabellón de Arteaga: Río San Pedro, 23-06-2015, J. L. Aguilar-Aguilar, 1 ♂, CZUAA SCO-182. Municipality of Tepezalá: Cerro del Capulín, 22°14’30.30” N, 102°09’30.13” W, 31-05-2020, I. Villalobos-Juárez, P. C. Hernández-Romero, D. F. Simijaca-Salcedo, F. Chávez-Samayoa, 1 ♂, CZUAA SCO-515; 22°14’16.19” N, 102°09’15.88” W, 6-06-2020, F. Chávez-Samayoa, 1 ♂, CZUAA SCO-542; 22°14’07.25” N, 102°09’25.16” W, 26-09-2020, F. Chávez-Samayoa, D. F. Simijaca-Salcedo, I. Villalobos-Juárez, 1 ♀, CZUAA SCO-563. Tepezalá, 21°13’54.41” N, 102°10’03.06” W, 2,116 m, 7-08-2015, M. Rodríguez. Guanajuato, Municipality of San Luis de la Paz: 7 km E of San Luis de la Paz, 21°18’42.84” N, 100°25’36.06” W, 2,117 m, 24-08-2006, O. F. Francke, H. Montaño, C. Santibáñez, A. Ballesteros, 2 ♂, CNAN-SC02455. Nuevo León, Municipality of Galeana: Carretera San Roberto-Galeana, km 78, 24°40’57.6” N, 100°06’24.0” W, 1,944 m, O. F. Francke, W. D. Sissom, K. McWest, B. Hendrixson, S. Grant, E. González S., M. Córdova, A. Jaimes, A. Ballesteros, 1 ♀, CNAN-SC2136. Providencia, 3 km NE, 25°08’39.06” N, 100°39’02.40” W, 1,980 m, 17-07-2006, O. F. Francke, E. González, M. Córdova, J. Ballesteros, A. Jaimes, 1 ♂, AMCC (LP 6558). 3km NW of La Providencia, 25°08’39.12” N, 100°39’02.88” W, 1,980 m, 17-07-2006, O. F. Francke, E. González, A. Jaimes, M. Córdova, A. Ballesteros, 5 ♂, CNAN-SC3108. Querétaro: Estación de Microondas Santa Lucia hacia Peña Miller, matorral espinoso, 21°03’28.30” N, 99°47’01.90” W, 13-11-2009, O. F. Francke, J. Cruz-López, C. Santibáñez, A. Valdez, 1 ♀ juv., CNAN-SC2133. San Luis Potosí, Municipality of Ciudad del Maíz: Puerto Santa Catarina, 22°18’13.38” N, 99°37’16.08” W, 1,214 m, 22-08- 2006, O. F. Francke, W. D. Sissom, G. Casper, T. Anton, V. Torti, H. Montaño, C. Santibáñez, A. Ballesteros, 1 juv., AMCC (LP 6610). Municipality of Villa de Arista: 10 km E of Villa de Arista, 22°38’45.60” N, 100°45’29.94” W, 1,624 m, 20-08-2006, O. F. Francke, D. W. Sissom, T. Anthon, V. Totti, G. Casper, H. Montaño, C. Santibáñez, A. Ballesteros, 2 ♂, CNAN-SC03107. Zacatecas, Municipality of Fresnillo: 23-05-2009, S. R. López-Navarro, 1 ♀, CZUAA SCO-168; 21-06-2009, R. López-Navarro, 1 ♂, CZUAA SCO-176. Municipality of Jalpa: 15-04-2005, J. Silva, 1 ♀, CZUAA SCO-167. Municipality of Saín Alto: Emiliano Zapata, 9-09-1971, S. Guijosa, 1 ♀, CNAN SC02456.

Remarks

Chihuahuanus glabrimanus is distributed in Aguascalientes, Coahuila, Guanajuato, Nuevo León, Querétaro, and San Luis Potosí (González-Santillán & Prendini, 2013, 2015). This species exhibits somewhat variable external morphology but is not correlated with its distribution, complicating its separation into morphospecies. Unlike diplocentrids, *C. glabrimanus* and *C. coahuilae* present some degree of substrate-specialism, having more and less elongated and alienated setae on the telotarsi, which is characteristic of the psammophilic ecomorphotype, an adaptation to digging in sandy soils (Polis, 1990; Prendini, 2001). Although we collected specimens in sandy areas, we failed to find a significant relationship between their presence and sandy habitats.

Figure 10. Habitus of male (top) and female (bottom) of *M. spadix*, scale = 1 cm.

Mesomexovis spadix (Hoffmann, 1931) (Fig. 10)

Taxonomic summary

Holotype: deposited in the American Museum on Natural History, New York, USA. México, Zacatecas, Municipality of Jalpa, 1 ♂, paratypes same locality deposited in UNAM 053, 1 ♂, 1 ♀ (Sissom, 2000).

Records from literature: González-Santillán & Prendini (2013): México, Guanajuato, Municipality of León: León, -04-2004, P. Berea, 1 ♂, 1 ♀, CNAN. Hoffmann (1931): México, Zacatecas, Jalpa. Santibáñez-López et al. (2015): México, Aguascalientes, Jalisco, Zacatecas. Sissom (2000): México, Aguascalientes, Jalisco, Zacatecas.

Examined material: Mexico, Aguascalientes, Municipality of Aguascalientes: Cerro de Los Gallos, 16-09-2014, J. E. Díaz-Plascencia, 2 ♀, CZUAA SCO-197; 27-11-1997, V. Villalobos-Sánchez, 1 ♀, CZUAA SCO-289; 26-11-1984, H. Gallegos-Rangel, 2 ♀, CZUAA SCO-295; 21-10-1989, M. E. Serafín-Luevano, 2 ♂, CZUAA SCO-297; -04-2015, C. A. Franco-Servín de la Mora, 2 ♀, CZUAA SCO-316. Cerro del Muerto, 23-05-2014, E. A. Hernández-Medrano, 1 juv. ♂, CZUAA SCO-248; 14-06-1979, J. Á. Uyoa, 1 ♀, CZUAA SCO-259; 10-04-2010, L. Consuelo-Márquez, 1 ♀, CZUAA SCO-268; 19-10-1988, J. A. Rodríguez-Avalos, 3 ♂, 4 ♀, CZUAA SCO-275; 21-10-1982, M. E. Serafín-Luevano, 2 ♂, CZUAA SCO-297. El Sauz, km 35, 19-04-1996, F. Arenas-Luevano, 1 ♂, CZUAA SCO-227. Municipality of Calvillo: Peña Blanca, 21°54’09.76” N, 102°45’15.48” W, 31-01-2022, I. J. Rodríguez-Elizalde, J. Brito-Ruiz de Velasco, 1 ♂, CZUAA SCO-724. Sierra Escondida, 21°43’32.12” N, 102°43’14.52” W, 10-02-2022, I. J. Rodríguez-Elizalde, J. Brito-Ruiz de Velasco, 1 ♂ juv., CZUAA SCO-725. 7 km NE of Temazcal, 22°02’36.46” N, 102°44’07.22” W, 2,246 m, 6-09-2021, I. J. Rodríguez-Elizalde, J. Brito-Ruiz de Velasco, 1 ♀, CZUAA SCO-682. Cercano a balneario “La Cueva”, 21°49’57.00” N, 102°48’58.82” W, 1,781 m, 28-10-2019, F. Chávez-Samayoa, S. S. Gutiérrez-Martínez,

1 ♀, CZUAA SCO-482; 15-10-2019, F. Chávez-Samayoa, 6 ♂, 22 ♀, CZUAA SCO-485. Los Adobes, 21°48’39.22” N, 102°41’21.34” W, 1,874 m, 11-10-2019, F. Chávez-Samayoa, L. R. Haro-Tapia, 2 ♀, CZUAA SCO-487. La Mezquitera, 21°51’39.85” N, 102°46’03.47” W, 5-10-2019, F. Chávez-Samayoa, M. E. Samayoa-Sepúlveda, L. F. Chávez-Rodríguez, 2 ♀, CZUAA SCO-511; 7-09-2019, F. Chávez-Samayoa, 7♂, 5♀, CZUAA SCO-513; 30-08-2019, J. A. Escoto-Moreno, F. Chávez-Samayoa, 4 ♀, CZUAA SCO-592. Presa La Codorniz, 21°59’50.78” N, 102°40’42.78” W, 2,068 m, 5-07-2021, F. Chávez-Samayoa, D. Ortiz-Álvarez, C. Huerta, 10 ♂, 12 ♀, CZUAA SCO-613; 22°00’39.07” N, 102°40’19.51” W, 1-11-2020, E. González-Martínez, J. L. Reyes-Hernández, I. E. Gallegos-Vieyra, D. F. Simijaca-Salcedo, F. Chávez-Samayoa, 1 ♀, CZUAA SCO-590. Presa Los Alamitos, 21°43’49.44” N, 102°42’50.04” W, 14-06-2021, M. E. Samayoa-Sepúlveda, F. Chávez-Samayoa, 1 ♀, CZUAA SCO-635; 17-05-2021, F. Chávez-Samayoa, D. Ortiz-Álvarez, 1 ♀, CZUAA SCO-649; 13-02-2021, D. G. Castillo-Arceo, N. D. Morales, 1 ♀, CZUAA SCO-663. Los Alisos, 4-03-2005, M. Orozco, 1 ♀, CZUAA SCO-311. El Ocote, 13-06-2009, M. Gómez, 1 ♀, CZUAA SCO-208; 11-06-2004, G. Guerrero, 1 ♀, CZUAA SCO-215; 12-06-2004, Benjamín, 1 ♀, CZUAA SCO-217; 13-06-2004, A. Del Río, 1 ♀, CZUAA SCO-255; 13-06-2004, S. Saucedo, 1 ♀, CZUAA SCO-267; -06-2002, E. N. Manzo-Mata, 2 ♀, CZUAA SCO-284; 13-06-2004, R. S. Pérez, 1 ♂, 1 ♀, CZUAA SCO-293. El Pilar, 2-05-2004, P. O. Hernández, 1 ♀, CZUAA SCO-214. La labor, caseta de vigilancia, 17-06-1992, J. A. Castorena Rangel, 1 ♀, CZUAA SCO-260. Las lomas, 3.5 km hacia Presa de los Serna, 14-10-1992, H. J. Cruz-González., 1 ♂, 1 ♀, CZUAA SCO-256. Las moras, 15-03-2007, S. Álvarez-Betancourt, 1 ♀, CZUAA SCO-442. Los Alisos, 12-09-1988, J. A. Rodríguez-Avalos, 2 ♀, CZUAA SCO-219; 22-01-2014, A. Farfán-Castañeda, 1 ♂, CZUAA SCO-224; 19-05-1982, V. Quintero, A. Salado, 2 ♂, CZUAA SCO-231; 9-10-1989, M. Y. Quezada, J. I. Soriano, 4 ♂, 4 ♀, CZUAA SCO-294; 3-10-2014, J. E. Díaz-Plascencia, 2 ♀, CZUAA SCO-417. Presa Malpaso, 13-06-2004, Hernández-Camacho, 1 ♀, CZUAA SCO-210; 1-06-2005, C. C. Herrada, 2 ♂, 3 ♀, CZUAA SCO-225; 13-06-2004, E. J. Ortiz-Martínez, 1 ♀, CZUAA SCO-244; 13-06-2004, L. Muro, 2 ♀, CZUAA SCO-250. Mesa Montoro, 4-05-1996, F. Arenas-Luevano, 1 ♀, CZUAA SCO-291. Río Gil, 11-06-2004, A.E.G.E., 2 ♀, CZUAA SCO-296. Sierra del Laurel, 18-04-2010, A. G. Pérez D., 1 ♀, CZUAA SCO-237; 29-08-2015, J. E. Díaz-Plascencia, 4 ♂, 3 ♀, CZUAA SCO-319; 11-02-2017, V. M. Arano-Sierra, 1 ♂, CZUAA SCO-415. Municipality of El Llano: Juan el Grande, 21°56’21.00” N, 101°55’06.00” W, 18-10-2019, F. Chávez-Samayoa, E. González-Martínez, 1 ♂, 1 ♀, CZUAA SCO-476; 21°56’22.45” N, 101°55’22.22” W, 23-08-2020, F. Chávez-Samayoa, 1 ♀, CZUAA SCO-534; 21°56’21.08” N, 101°55’17.87” W, -10-2019, E. González-Martínez, 6 ♂, 5 ♀, CZUAA SCO-544; 21°56’20.00” N, 101°55’09.84” W, 2,488 m, 27-02-2021, F. Chávez-Samayoa, D. F. Simijaca-Salcedo, 1 ♂, CZUAA SCO-642. Municipality of Jesús María: Los Muñozes, 21°57’00.14” N, 102°34’00.66” W, 2,179 m, 12-10-2019, F. Chávez-Samayoa, M. J. Morán-Gutiérrez, V. M. Arano-Sierra, 3 ♂, 9 ♀, CZUAA SCO-478; 16-10-2019, F. Chávez-Samayoa, 2 ♂, 7 ♀, CZUAA SCO-479. Los Arquitos, 21°55’21.68” N, 102°23’17.92” W, 1,931 m, 4-09-2019, F. Chávez-Samayoa, 6 ♂, 22 ♀, CZUAA SCO-485; 4-09-2019, I. Villalobos-Juárez, 4 ♀, CZUAA SCO-512; 21°55’12.51” N, 102°23’47.53” W, 2,034 m, F. Chávez-Samayoa, D. F. Simijaca-Salcedo, 3 ♀, CZUAA SCO-639; 21°55’18.66” N, 102°23’34.79” W, 1,964 m, 26-03-2021, F. Chávez-Samayoa, D. F. Simijaca-Salcedo, 2 ♀, CZUAA SCO-640. Pileta, 21°57’20.92” N, 102°30’02.92” W, 2,167 m, 6-09-2019, J. A. Escoto-Moreno, F. Chávez-Samayoa, 1 ♀, CZUAA SCO-593. Campamento Yuca, 22°02’20.37” N, 102°24’43.12” W, 2,262 m, 7-10-2019, M. J. Perales-Olivares, 1 ♀, CZUAA SCO-465. Cerro El Picacho, 18-10-1986, P. Serna-Pérez, 1 ♀, CZUAA SCO-263; 13-11-1985, J. G. Vázquez A., 1 ♀, CZUAA SCO-267; -08-2020, C. Ramírez, 1 ♀, CZUAA SCO-587. La Posta, 5-06-2014, E. Águila-Lira, 1 ♂, CZUAA SCO-236. Rancho Seco, 21-04-2019, V. M. Arano-Sierra, 1 ♂, 1 ♀, CZUAA SCO-472. Municipality of Pabellón de Arteaga: 25-06-1999, C. A. Ramírez, 1 ♀, CZUAA SCO-228. Municipality of Rincón de Romos: Sierpe, Y. Calvillo Lezama, 1 ♂, 1 ♀, CZUAA SCO-298. Rincón de Romos, 17-04-2004, N. Arroyo-Chávez, 1 ♂, CZUAA SCO-243; 20-06-1999, P. Hernández, 1 ♀, CZUAA SCO-258; 20-11-1999, L. F. de Alba, 1 ♀, CZUAA SCO-271; 23-03-1999, B. Saucedo, 1 ♀, CZUAA SCO-274. Municipality of San Francisco de los Romo: 6-06-2016, A. Bernal, 1 ♀, CZUAA SCO-446. Municipality of San José de Gracia: Estación Biológica Agua Zarca, 22°05’32.3” N, 102°33’20.3” W, 2,149 m, 20-03-2019, E. C. Ramírez, 1 ♂, 4 ♀, CZUAA SCO-547; 12-03-2003, Y. Gámez-Roldán, 1 ♂, CZUAA SCO-198; -02-2003, A. Morales, 1 ♀, CZUAA SCO-201; 18-03-2003, C. Quiñones-Valles, 1 ♀, CZUAA SCO-203; 29-03-2003, C. A. Morales-Asencio, 1 ♀, CZUAA SCO-204; 30-03-2014, J. Montero, 1 ♀, CZUAA SCO-211; 5.-04-2014, J. E. Díaz-Plascencia, 1 ♂, 2 ♀, CZUAA SCO-213; 31-05-2014, F. Chávez-Samayoa, 1 ♀, CZUAA SCO-238; 31-05-2014, R. González-Muñoz, 1 ♀, CZUAA SCO-241; -02-2003, A.P.R.A., 1 ♂, CZUAA SCO-288; 30-05-2014, A. Mejía-Arellano, 1 ♂, CZUAA SCO-314; 28-04-2004, L. Rodríguez, 1 ♀, CZUAA SCO-315; 13-

05-2016, O. Herrera, 1 ♀, CZUAA SCO-406; 20-05-2016, L. R. Haro-Tapia, 1 ♂, CZUAA SCO-409; 18-05-2018, F. S. Álvarez-Solís, 1 ♀, CZUAA SCO-414; 27-05-2016, I. Rodríguez-Ortiz, 1 ♀, CZUAA SCO-428. Guanajuato, Municipality of León: Colonia La Luz, V. H. González, 1 ♂, CZUAA SCO-230; León, 25-06-2007, M. Ávila, 1 ♀, CZUAA SCO-410. Municipality of Guanajuato: 26-05-2007, D. García, 1 ♀, CZUAA SCO-426. Municipality of Salamanca: J. A. Berlín-Diosdado, 1 ♀, CZUAA SCO-226. Jalisco, Municipality of Lagos de Moreno: Cerro La Bola, 18-02-2012, R. E. Rea-Reyes, 1 ♀, CZUAA SCO-222. Lagos de Moreno, 24-04-2016, C. E. Valdivia-Muñoz, 1 ♀, CZUAA SCO-451. Municipality of Guadalajara: 6-06-2017, O. Gutiérrez-Muñoz, 1 ♂, 1 ♀, CZUAA SCO-423. Zacatecas, Municipality of Guadalupe: Cerro de la Virgen, 1-06-2003, C. A. Barrón, 1 ♀, CZUAA SCO-262. Municipality of Jerez de García: Sierra de Los Cardos, 14-10-2015, R. A. Rosales-García, 1 ♂, 1 ♀, CZUAA SCO-313. Cerro de la Campana, 17-03-2014, R. A. Rosales-García, 1 ♂, 1 ♀, CZUAA SCO-209. Jerez, 2-11-1986, R. Macías-Ramírez, 1 ♀, CZUAA SCO-234. Municipality of San Pedro Piedra Gorda: Chiquihuitillo, 22-09-1990, M. G. Flores Olivares, 1 ♂, CZUAA SCO-245.

Remarks

Mesomexovis spadix occurs in Aguascalientes, Guanajuato, Jalisco, and Zacatecas (González-Santillán & Prendini, 2013; Hoffmann, 1931; Santibáñez-López et al., 2015; Sissom, 2000).

Hoffmann (1931) synonymized *Vaejovis punctatus spadix* and *Vaejovis punctatus variegatus* Pocock, 1898 with *Vaejovis punctatus punctatus*, although he recognized some differences, he did not consider them enough to separate species. Later, González-Santillán and Prendini (2013) erected *Mesomexovis* and elevated them to species rank as *M. spadix* and *Mesomexovis variegatus*. Some authors have enlisted *Mesomexovis punctatus* as part of Aguascalientes species richness (Ponce-Saavedra & Francke, 2013b; Contreras-Félix et al., 2015), probably confounding the former nominotypical subspecies.

Mesomexovis spadix is a very abundant lapidicolous species covering most of the territory of Aguascalientes and tolerates disturbed environments. We collected specimens in 7 of the 11 municipalities of the state: Aguascalientes, Calvillo, El Llano, Jesús María, Pabellón de Arteaga, Rincón de Romos, and San José de Gracia. Although *M. spadix* occupies the 3 biogeographical provinces in Aguascalientes, the Chihuahuan desert appears to limit its distribution to the northern territories, which is congruent with the prediction of González-Santillán and Prendini (2013), who mentioned that *Chihuahuanus* ecologically substitutes *Mesomexovis* in more arid areas.

Thorellius intrepidus (Thorell, 1876) (Fig. 11)

Taxonomic summary

Holotype: deposited in the Naturhistoriska Riksmuseets Stockholm, Sweden. The only information associated to the holotype is: México 1 ♀ (Sissom, 2000).

Records from literature: González-Santillán and Prendini (2013): México, Colima, Municipality of Armería: Mine la Salada, NW Ixtlahuacan, 19°01’40.85” N, 103°47’02.21” W, 275 m, mine staff, 1 ♂, 1 ♀, AMNH. Municipality of Tecomán: Tecomán, 18°54’30.00” N, 103°52’28.00” W, 1 ♂, 1 ♀, AMNH. González-Santillán & Prendini (2018): México, Aguascalientes, Municipality of Calvillo: Chiquihuitero, 21°52’27” N, 102°42’09” W, 1,680 m, 29-06-2007, A. Valle Colis , 1 ♂, INDRE; El Rodeo, 21°52’09” N, 102°44’50” W, 1,620 m, 25-06-2007, A. Valle Colis, 1 ♀, INDRE; La Labor, 21°57’43” N, 102°41’46” W, 1,740 m, 15-18-06-2007, I. Escalante-Piña, 1 ♂, 1 ♀, INDRE; Rancho Media Luna, 21°47’56” N, 102°48’05” W, 1,560 m, 9-11-2008, I. Franchini, 1 ♀, INDRE; Mesa Grande, 21°48’18” N, 102°43’18” W, 1,760 m, 24-06-2003, G. Vargas, 1 ♀, INDRE, 24-06-2007, M. Sema, 1 ♂, INDRE. Colima, Municipality of Armeria: Armeria, 18°56’03” N, 103°57’52” W, 40 m, 2-01-2003, H. Rodríguez, 1 ♂, 1 ♀, CNAN SC2628. Mina La Salada, NW Ixtlahuacán, at mine headquarters, 19°01’40.80” N, 103°47’02.16” W, 275 m, 2005, mine staff, 11 ♀, AMNH. Municipality of Camotlán: Punta de Agua, 19°09’00.00” N, 104°16’00.00” W, 2-09-2003, E. González, 1 ♀, CNAN SC2242. Municipality of Colima: Colima, 19°14’36.00” N, 103°43’28.98” W, 30-12-1927, J. C. Chamberlin, 1 ♂, AMNH. Colima, 16 km S, 19°14’37” N, 103°43’51” W, 30-07-1954, W. J. Gertsch, 1 ♂, AMNH. Los Ortices, 19°06’46.8” N, 103°44’22.6” W, 343 m, 9-04-2004, P. Berea, 1 ♂, AMCC (LP 6379). Municipality of Comala: Comala, 19°19’00.00” N, 103°45’00.00” W, 9-04-2004, P. Berea, 1 juv. ♀, AMCC (LP 6377). Municipality of Coquimatlán: near Coquimatlán, 19°18’00.00” N, 104°06’00.00” W, 2008, L. L. Valdez, 1 ♂, CNAN SC2921. Municipality of Manzanillo: Los Parajes, 19°14’07” N, 104°24’52” W, 230 m, 3-02-2008, 1 ♂, INDRE. Manzanillo, 19°03’08” N, 104°18’57” W, 5 m, 1 ♀, INDRE, 17-01-1947, 2 ♂, 4 ♀, 1 subad. ♂CNAN SC2634. Manzanillo, 10 km of El Colomo, 19°03’08” N, 104°18’57” W, 16-04-2008, P. Berea, 1 ♀, CNAN SC2619. Colonia Valle de Las Garzas, 19°03’08” N, 104°18’57” W, 29-09-2008, 5 m, 1 ♀, INDRE. Manzanillo, Sector 7, 19°03’08” N, 104°18’57” W, 5 m, 6-02-2004, 1 ♂, INDRE. Nuevo Petatero Ranch, 19°03’38.94” N, 104°16’36.12” W, 4-02-2008, 1 ♀, INDRE. Potrero Grande, 19°10’19” N, 104°32’27” W, 6 m, 27-11-2008, 1 ♀, INDRE. Veladero de Otates, 19°15’38”

Figure 11. Habitus of male (top) and female (bottom) of *T. intrepidus*, scale = 1 cm.

N, 104°20’14” W, 280 m, 4-02-2008, 1 ♀, INDRE. Municipality of Minatitlán: Junction to Saus, on way to Minatitlán, 19°25’22.74” N, 103°58’59.94” W, 1,006 m, 26-05-2006, O. F. Francke, A. Valdez, H. Montaño, A. Ballesteros, 1 ♂, AMCC (LP 6469). Municipality of Tecomán: Tecomán, 18°54’30” N, 103°52’28” W, 8-05-1961, E. López, 1 subad. ♀, INDRE, -03-1992, Orozco, R. G., 1 ♂, INDRE, 30 m, 9-03-1992, R. Lezama, 3 ♂, 6 ♀, CNAN SC2629, around village, 29-11-1995, E. López, 1 ♀ 1 subad. ♂, CNAN SC2611, 12-01-1996, M. González, 1 ♀, CNAN SC2605, 18-02-1996, H. Arredondo, 1 ♀, CNAN SC2641, 19-06-1996, H. Arredondo, 1 ♀, INDRE. Municipality of Villa de Álvarez: Villa de Álvarez, 19°16’00.00” N, 103°44’15.00” W, 530 m, 11-02-1995, E. Polanco, 1 ♀, CNAN SC2618. Guanajuato, Municipality of León: Hacienda de Arriba, NE of León, in house, 2008, L. Olguín, 2 ♀, CNAN SC2922; León, 21°07’00.00” N, 101°41’00.00” W, 2-06-2006, 1 ♂, CNAN SC2612. Jalisco, Municipality of Jocotepec: San Juan Cosola, 1.6 km E, 20°17’12.00” N, 103°20’13.02” W, 10-07-1959, C. M. Bogert, 1 ♀, AMNH. Muncipality of La Huerta: Ejido E. Zapata, 19°22’58” N, 104°57’55” W, 10 m, 9-07-1994, I. Ramírez, 1 ♀, CNAN SC2606. Estación Biológica Chamela, 19°29’52.50” N, 105°02’36.48” W, 5-04-1981, M. V. Julia, 1 ♀, CNAN-SC2244, 20 m, 19-05-1985, A. Pescador, 1 subad. ♀, CNAN-SC2607; 26-04-1993, E. Ramírez, 1 ♂, CNAN SC2614; 25-03-1998, S. H. Bullock, 1 ♀, CNAN-SC2920; 14-09-1999, A. M. Corona, R. Ayala, 1 ♀, CNAN-SC2621; 19-09-1999, A. M. Corona, 1 ♀, CNAN-SC2622; 1-09-2011, O. F. Francke, A. Valdez, H. Montaño, A. Ballesteros, C. Santibáñez, 3 ♂, 1 ♀, CNAN-SC2245; 19°29’52.50” N, 105°02’36.48” W, 97 m, 30-08-2007, O. Francke et al., 1 juv. ♀, AMCC (LP 7670); Estación Biológica Chamela, El Tejon Trail, 19°29’50.16” N, 105°02’29.46” W, 18-08-2005, J. L. Castelo, UV detection at night, 1 juv., AMCC (LP 5309). Michoacán, Municipality of Aquila: Aquila, 18°35’57” N, 103°30’15” W, 180 m, 21-02-1992, R. Mares, 1 ♀, CNAN-SC2636. Arroyo de la Cruz, 5 km NE of Maquili, 18°34’33.5” N, 103°35’47.8” W, 24-01-2004, 1 ♂, 2 ♀ 1 subad. ♂ 1 subad. ♀, CNAN-SC2992. El Faro de Bucerías, tropical dry forest, 18°21’00.00” N, 103°29’00.00” W, 13/14-01-2002, E. González, 1 ♀, AMCC (LP 2022); El Faro de Bucerías, near La Llorona 18°20’40.74” N, 103°30’32.04” W, 17-01-2006, G. Suárez, CNAN-SC2624. Pomaro, 18°20’28” N, 103°18’29” W, 380 m, 1 ♂, 18-02-1992, R. Álvarez, 1 ♀, CNAN-SC2608. Municipality of Coahuayana: Coahuayana, 18°45’00.00” N, 103°40’00.00” W, 24-06-1991, M. J. Nereida, 1 ♀, CNAN-SC2615. Municipality of Jiquilpan: Jiquilpan, 19°59’37” N, 102°43’02” W, 1,560 m, G. Ignacio, 1 ♂, 1 ♀, CNAN-SC2616. University of Michoacán, 19°41’27.96” N, 101°12’09.78” W, 1 ♂, CNAN-SC2613. Municipality of Uruapan: Uruapan, 19°25’10” N, 102°03’30” W, 1,620 m, J. Julia, 1 ♂, CNAN-SC2610. Nayarit, Municipality of Tepic: La Loma motel, 21°30’30.00” N, 104°53’34.98” W, C.M. Bogert, 1 ♀, AMNH. Santibáñez-López et al. (2019): México, Colima, Municipality of Coquimatlán: El Palapo, 19°11’54.60” N, 102°54’49.68” W, 3-04-2015, J. Valencia, J. López, E. González. Soleglad & Fet (2008): México, Nayarit, Municipality of Tepic: 1 ♀, MES, 1 ♀, GL.

Examined material: Mexico, Aguascalientes, Municipality of Calvillo: Calvillo, 9-06-2021, I. J. Rodriguez-Elizalde, 1 ♂, CZUAA SCO-609. Terrero de la Labor, 22°01’32.02” N, 102°39’58.00” W, 1,927 m, 22-10-2021, F. Chávez-Samayoa, D. Ortiz-Álvarez, 1 ♀, CZUAA SCO-656. Presa de los Serna, 3-10-2003, S. García, 1 ♀, CZUAA SCO-188; 3-10-2003, S. García, 1 ♂, CZUAA SCO189. Calvillo, 8-11-2021, R. García, 1 ♂, CZUAA SCO-669. Jalisco, Municipality of Encarnación de Diaz: 5-06-2009, E. Duar, 1 ♀, CZUAA SCO-378. Municipality of San Juan de los Lagos: 14-04-2011, F. A. Rubalcaba-Castillo, 1 ♀, CZUAA SCO-194.

Remarks

Thorellius intrepidus inhabits the states of Aguascalientes, Colima, Guanajuato, Jalisco, Michoacán, and Nayarit, inhabiting tropical dry forests, deciduous and broadleaf forests between 5 and 1,760 m altitude (González-Santillán & Prendini, 2018).

In Aguascalientes, we recorded *T. intrepidus* at 1,927 m of altitude (CZUAA SCO-656), which may represent most likely its altitudinal distribution limit at circa 2,000 m. *Thorellius intrepidus* is restricted to the tropical deciduous forest of the Calvillo Municipality. Like *C. infamatus*, *T. intrepidus* inhabits the Pacific Lowlands province, which may be a second component that invaded or diversified within that area. However, all the species of *Thorellius* are distributed in tropical to subtropical habitats (González-Santillán & Prendini, 2018) connected to the Pacific Lowlands, which suggest that the linage may have originated in the Pacific Lowlands province.

Smeringurinae Soleglad & Fet, 2008
Paruroctonus gracilior Hoffmann, 1931 (Fig. 12)

Taxonomic summary

Lectotype: deposited in the American Museum of Natural History, New York, USA. Tepezalá, Aguascalientes, México, 1 ♂ and 2 paralectotypes ♂♂.

Records from literature: Brown et al. (2002): USA, Texas, Terrel County: Chandler Independence Creek Preserve, 30°26’30.00” N, 101°43’26.00” W. Bryson

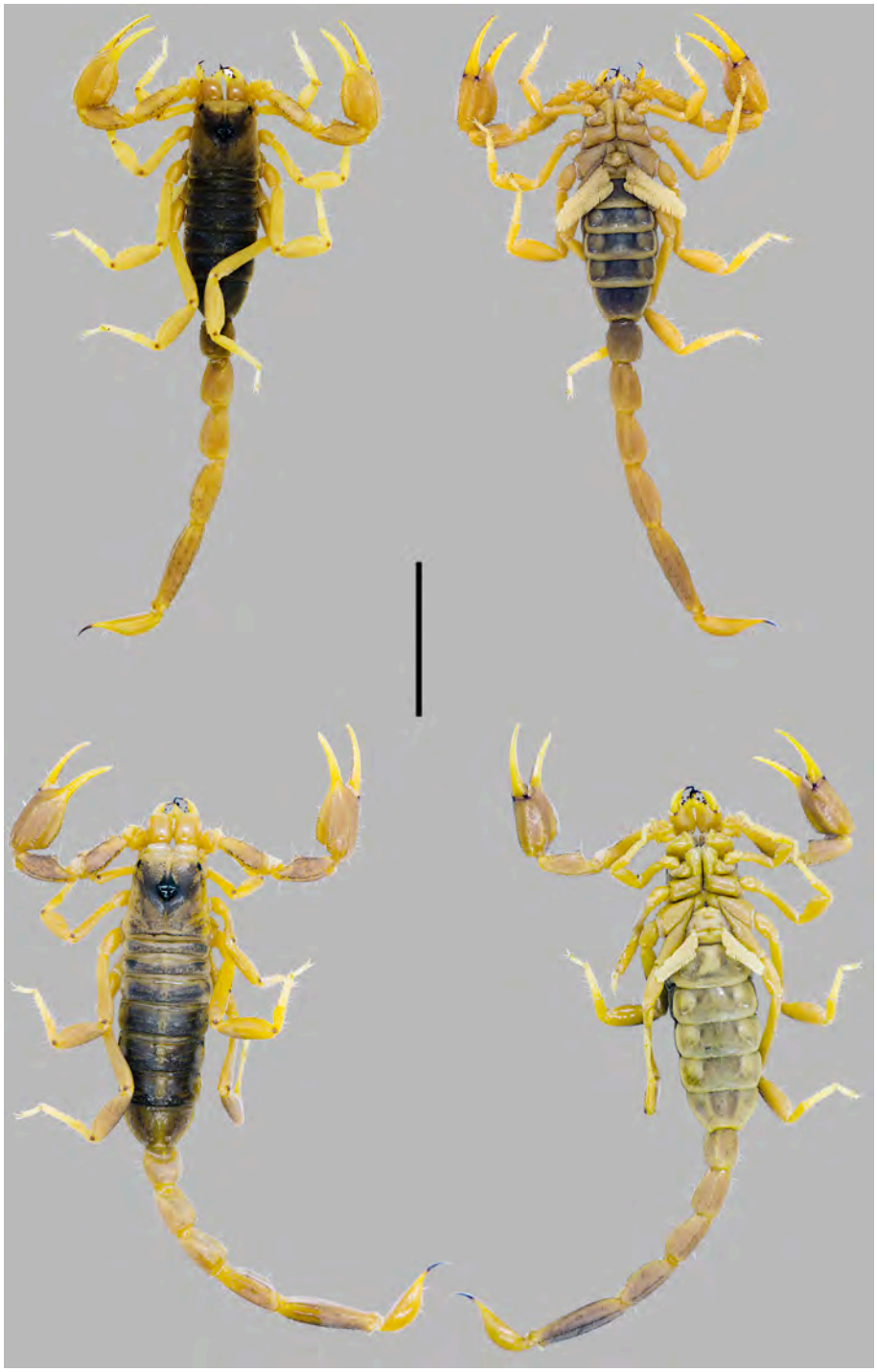

Figure 12. Habitus of male (top) and female (bottom) of *P. gracilior*, scale = 1 cm.

Jr. (2014): USA, Arizona, Cochise County. Fet et al. (2006): México, Coahuila, Municipality of Cuatro Ciénegas: 2 ♂, MES. USA, New Mexico, Hidalgo County: Lordsburg, 1 ♂, GL. Gertsch & Soleglad (1966): México, Aguascalientes, Municipality of Tepezalá: C. C. Hoffmann, 3 ♂ cotypes, AMNH. Coahuila, Municipality of Saltillo: 32.1 km E of Saltillo, 16-07-1965, W. J. Gertsch, V. Roth, 1 ♂. USA, Arizona, Cochise County:

Portal, 1-07- to 4-09-1965, R. M. Hastings, W. J. Gertsch, V. Roth, 27 ♂, 4 ♀. New Mexico, Hidalgo County: Rodeo, 29-08-1964, R. Hastings, 1 ♂. Eddy County: Hope, 23-09-1950, W. J. Gertsch, 1 ♀. Hoffmann (1931): México, Aguascalientes, Municipality of Tepezalá: 4 ♀. Sissom & Francke (1981): USA, New Mexico, Chaves County: 30.8 km W Caprock, 21-03-1980, J. E. Cokendolpher, 1 ♀, JCC. Eddy County: Carlsbad Caverns National Monument, 8-09-1969, M. A. Cazier, J. Bigelow, 4 ♂, 5 ♀, AMNH. 24.1 km E Loving (creosote scrub and dunes), -07-1978, C. Rudoph, 9 ♂, AMNH. Hidalgo County: 20.9 km N Rodeo, 25-06-1973, O. F. Francke, 2 imm., AMNH. Hope, 23-09-1950, W. J. Gertsch, 1 ♀. Rodeo, 29-08-1964, R. Hastings, ♂. Luna County: Rock Hound State Park, 14.4 km E Deming, J. Bigelow, 1 ♂, 1 ♀, AMNH. Texas, Brewster County: Castolon, Big Bend National Park, 8-08-1979, O. F. Francke, J. V. Moody, F. Merickel, 1 ♂, AMNH; Grapevine Ranch, N base of Grapevine Mountain, Big Bend National Park, 7-09-1969, M. A. Cazier, J. Bigelow, 15 ♂, 3 ♀, 2 imm, AMNH. Culberson County: 1.6 km N Kent, 23-06-1970, M. A. Cazier, L. Welch, O. F. Francke, 4 ♀, 3 imm., AMNH. Jeff Davis County: Panthon Spring, 25-06-1968, J. C. Lewis, 1 ♀, AMNH. 5.3 km N Presidio, 2-09-1972, J. Davidson, O. F. Francke, 8 ♂, 11 ♀, AMNH. 4.6 km E Presidio, 2-09-1972, J. Davidson, O. F. Francke, 6 ♂, 3 ♀, 1 imm., AMNH. 57.9 km S Marfa, 2-05-1980, L. Robbins, 2 juv., AMNH. Val Verde County: 0.8 km S Langry, 14-06-1974, L. Draper, A. Cazier, O. F. Francke, 1 ♀, AMNH. Winkler County: 4.8 km W Wink, 7.-04-1979, W. D. Sissom, 2 ♂, WDS. Soleglad and Fet (2008): México, Coahuila, Municipality of Cuatro Ciénegas: 1 ♂ 1 ♀, MES. USA, New Mexico: 1 ♂, MES. Texas, Brewster County: Lajitas, 1 ♂, GL. Stockwell (1986): USA, Texas, Brewster County: 4 km S of Alpine, 19-08-1968, S. C. Williams, J. Bigelow, M. M. Bentzien, 1 ♂, CAS. Big Bend National Park Grapevine Ranch, N base of Grapevine Mt., 7-09-1969, J. Bigelow, M. A. Cazier, 19 ♂, 5 ♀, AMNH; Big Bend National Park, 19.3 km SE Panther Jct., 17-08-1968, S. C. Williams, M. A. Cazier, 3 ♂, 3 ♀, CAS. 21.2 km SE of Panther Jct., 17, 17-08-1968, S. C. Williams, M. M. Bentzien, 14 ♂, 10 ♀, CAS. Big Bend National Park, Castalon, 8-08-1979, O. F. Francke, J. V. Moody, 1 ♂, AMNH. Crockett County: 10 mi. N of Iraan, 8-03-1986, S. A. Stockwell, J. M. Steele, 2 ♂, 4 ♀, SAS. Culberson County: 19.3 km E of Van Horn, 3-07-1965, M. H. Muma, 1 ♀, CAS. 1.6 km N of Kent, 25-06-1970, M. A. Cazier, Welch, O. F. Francke, 3 ♂, 4 ♀, AMNH. Hudspeth County: 12.8 km W of Van Horn, 11-06-1982, W. D. Sissom, 1 ♀, AMNH. Jeff Davis County: Phantom Springs, 25-06-1968, J. C. Lewis, 1 ♀, AMNH. Pecos County: 16.1 km N, 3 mi. W of Fort Stockton, 6-08-1967, W. L. Minckley, 1 ♂, CAS. Presidio County: Candelaria, 26-09-1977. R. Wilson, et al., 2 ♂, 1 ♀, CAS. 57.9 km S of Marfa, 2-05-1980, L. Robbins, 2 ♀, MWSU. 11.26 km N of Presidio, 27-11-1975, J. C. Cokendolpher, 1 ♀, MWSU. 5.3 km N of Presidio, 2.ix.1972, J. Davidson, O. F. Francke, 10 ♂, 11 ♀, AMNH. Val Verde County: 0.8 km S of Langtry, 14-06-1974, L. Draper, M. A. Cazier, O. F. Francke, 1 ♀, AMNH.

Examined material: Mexico, Aguascalientes, Municipality of Tepezalá: Cerro del Capulín, 22°14’30.30” N, 102°09’30.13”, 2159 m, 31-05-2020, F. Chávez-Samayoa, D. F. Simijaca-Salcedo, P. C. Hernández-Romero, 1 ♂, CZUAA SCO-517; 22°14’16.19” N, 102° 09’15.88” W, 2,138 m, 29-06-2020, F. Chávez-Samayoa, 1 ♀, CZUAA SCO-521; 22°14’06.83” N, 102°09’15.77” W, 2,130 m, 21-08-2020, F. Chávez-Samayoa, 2 ♂, 3 ♀, CZUAA SCO-539; 22°14’07.25” N, 102° 09’25.16” W, 2,117 m, 26-09-2020, F. Chávez-Samayoa, 1 ♀, CZUAA SCO-562; 22°13’52.88” N, 102°09’36.77” W, 2,127 m, 23-10-2020, I. Villalobos-Juárez, F. Chávez-Samayoa, D. F. Simijaca-Salcedo, 1 ♂, CZUAA SCO-576. San Luis Potosí, Municipality of Charcas: 23°16’00.36” N, 100°54’06.06” W, 2,029 m, -08-2010, O. F. Francke, D. W. Sissom, T. Anthon, G. Casper, V. Totti, H. Montaño, C. Santibáñez-López, A. Ballesteros, CNANSC2008. San Luis Potosí Municipality: 6-11-2009, D. Muro, 1 ♂, CZUAA SCO-394.

Remarks

Paruroctonus gracilior is distributed in Aguascalientes, Chihuahua, Coahuila, Durango, San Luis Potosí and the southern states of Arizona, New Mexico, and Texas in the USA (Francke, 2019).

Paruroctonus gracilior type locality is Tepezalá, the only municipality with specimens deposited in the CZUAA. Clearly, a psammophilous species component of the Chihuahuan desert adapted to sandy soils. We infer that populations could be established only in places with adequate substratum. In consequence, we suspect that, like *D. zacatecanus*, *P. gracilior* is a case of a complex of substrate-specialist species and is an excellent candidate to evaluate under a multispecies coalescence model (Degnan & Rosenberg, 2009) to test whether the species represents 1 or multiple lineages in such a wide distribution area, encompassing almost all Chihuahuan Desert.

Vaejovinae Thorell, 1876

The genus *Vaejovis* C. L. Koch in Aguascalientes is represented in the state by the *mexicanus* (Contreras-Félix & Francke, 2019) and *nitidulus* (Sissom & González-Santillán, 2004) species group.

Figure 13. Habitus of male (top) and female (bottom) of *V. nigrescens*, scale = 1 cm.

Vaejovis nigrescens Pocock, 1898 (Fig. 13)

Taxonomic summary

Holotype: deposited in the British Museum of Natural History, England, UK. The only information associated to the specimen is a label indicating Mexico, 1 ♀ (Sissom, 2000).

Vaejovis nigrescens is distributed in Aguascalientes, Estado de México, Guanajuato, Jalisco, Michoacán, Querétaro, and Zacatecas (Sissom & González-Santillán, 2004).

Records from literature: Fet et al. (2006): México, Hidalgo, Muncipality of Pachuca: 2 ♀, MES. Sissom and Francke (1985): México, Aguascalientes, unspecified

municipality: Río de Pirules, 1 ♀, AMNH. Ciudad de México: Mexico City, 4 ♂, 2 ♀, TOR Sc 516, ex. 617. Durango, Muncipality of Gómez Palacio: Dinamita, TOR Sc 517, ex. 656. Guanajuato, Muncipality of Guanajuato: Duges, 4 ♀, MNHN RS-0668; 2 ♀, MNHN RS-0678; 1 ♀, MNHN RS-0684; 1 ♂, 5 ♀, 7 first instars, MNHN RS-0671; in houses, Duges, 3 ♂ 4 ♀, TOR Sc 515; ex. 616, 2 ♀, BM; 1 ♀, BM; -06-1963, S. A. Minton, 1 ♀, SAM. Sissom and González-Santillán (2004): Mexico, Guanajuato, Municipality of Apaseo de Alto: 3 km S Huapango, 12-09-98, L. Ramírez, 1 ♂, UAQ LE00043. Municipality of Apaseo El Grande: El Tunal, 28-05-2000, A. R. Arias, 1 ♀, INDRE. Municipality of Atarjea: El Pilar (El Pilón) on wall of house, 12-05-2001, M. Suárez, 1 ♀, INDRE. Municipality of Celaya: 23-06-1979, M. Robledo, 2 ♂, 3 ♀, ENCB-IPN No. 49. Municipality of León: 27-05-1965, 1 ♂, 3 ♀, INDRE. Municipality of Irapuato: Rancho Cuchichuato, 25-04-2001, E. Martínez Zavala, 1 ♂, INDRE. Municipality of Samalanca: 20-05-2001, V. Jaime, 1 ♂, 1 ♀, ENCB-IPN. Municipality of Salvatierra: Emenguaro, -02-1969, 1 ♀, INDRE Sc 88199. Salvatierra, 31-10-1999, J. Callzontzin, 1 ♀ juvenile, UAQ. San José del Carmen, -01-1969, 2 ♂, 1 ♀, INDRE Sc 88195. San Pedro de los Naranjos, -02-1969, 3 ♂, 12 ♀, 2 juv. ♀, INDRE. Santiago Maravatio, -02-1969, 1 ♀, 2 juv. ♀, INDRE Sc 88198. Municipality of Victoria: Agua Fría, in house, 10-05-2001, M. Rivera-Díaz, 1 ♂, 1 ♀, INDRE. Jalisco, Municipality of La Huerta: Chamela, 04-04-1977, 1 ♀, CNAN-SC2497. Municipality of San Juan de los Lagos: 31-03-1979, H. Plascencia, 1 ♂, ENCB-IPN no. 189. Estado de México, Municipality of Ixtapan del Oro: 8-06-1941, CNAN-SC2499. Michoacán, Municipality of Apatzingan: 30-06-1989, L. Rios, 2 ♂, CNAN. Municipality of Hidalgo: Ciudad Hidalgo, 12-06-1987, I. Estrella, 1 ♂, CNAN-SC2505. Municipality of Huandacareo: 18-05-1989, D. A. Fernández, 1 ♂, CNAN; 15-05-1989, 2 ♀, CNAN. Municipality of Juárez: Parícuaro, 31-06-1988, B. Castro-Zarco, 1 ♀, CNAN -SC2506. Municipality of Junganpeo: Agua Blanca, in house, 1 ♂, CNAN-SC2508. Municipality of La Piedad: 25-06-1987, M. Méndez, 1 ♀, CNAN-SC2504. Municipality of Morelia: 15-06-1987, Á. Tinoco, 1 ♂ juv., CNAN-SC2502; 7-09-1986, J. Fabela, 1 ♂, CNAN; 30-06-1987, Ma. De J. Nereyda, 1 ♂, 1 ♀, CNAN-SC2496; 28-05-1987, R. Maya, 2 ♂, CNAN-SC2501; 7-06-1987, I. Tinoco, 1 ♂, CNAN-SC2494; 12-05-1986, 2 ♀, CNAN-SC2498; 11-07-1987, O. Barriga, 1 ♀, CNAN-SC2491; 8-08-1984, J. López, 1 ♂, CNAN-SC2516. El Reolito, 2 juv., J. Ponce, CNAN-SC2510. Municipality of Taretan: 12-07-1996, 1 ♂, CNAN-SC2492. Municipality of Uruapan: 3-05-1988, M. Moreno G, 1 ♂, CNAN- SC2511. Municipality of Zamora: 2-06-1991, A. R. Santos, 1 ♀, CNAN-SC2509. Municipality of Zitacuaro: 6-06-1985, 1 ♀, CNAN-SC2500. Querétaro, Municipality of Querétaro: 7-09-1998, R. Barron, Cid, Morales, 1 ♀, UAQ-LE0008. Zacatecas: Aguas Frías, -06-1963, 1 ♂, INDRE Sc 88203.

Examined material: Mexico, Aguascalientes, Municipality of Aguascalientes: Puertecito de la Virgen, 21°57’41.90” N, 102°16’04.37” W, 20-10-2020, C. Ramos, D. Rivero, 1 ♂, CZUAA SCO-569; -05-2015, L. Ruíz, 1 ♂, CZUAA SCO-354. Cañada Honda, 12-05-2010, N. Parga-Flores, 1 ♀, CZUAA SCO-353. Jardín Botánico Rey Netzahualcóyotl, 25-04-2014, R. Rivera-Martínez, 1 ♂, CZUAA SCO-346. Aguascalientes, 29-05-2012, S. Valencia-Chico, 1 ♀, CZUAA SCO-348; 12-05-2014, L. P. Cervantes-Zavalsa, 1 ♂, CZUAA SCO-351. Municipality of Asientos: Presa Charcos Verdes, 6-04-1994, A. Muñoz, 1 ♀, CZUAA SCO-361. Municipality of Calvillo: Presa Malpaso, 10-06-2004, F. Ramos-Martínez, 1 ♀, CZUAA SCO-345; 13-06-2023, E. Calvillo, 1 ♂, 2 ♀, CZUAA SCO-735. Municipality of Jesús María: Maravillas, 7-05-2004, L. F. López, 1 ♀, CZUAA SCO-350; Jesús María área urbana, A. Carmona, 1 ♂, CZUAA SCO-344. Municipality of Rincón de Romos: 17-04-2004, C. Arias-Camino, 1 ♀, CZUAA SCO-352. Guanajuato, Municipality of Guanajuato: 25-06-1999, L. L. O., 1 ♀, CZUAA SCO-336; 15-04-2014, C. D. Andrade-Moreno, 1 ♀, CZUAA SCO-341; 25-06-2007, M. C. Flores-Banderas, 1 ♂, CZUAA SCO-427. Municipality of Irapuato: 25-04-1999, M. Martínez-Garnica, 1 ♂, CZUAA SCO-333; 05-09-1987, Eliazarrás-Rivera, González-López, 1 ♂, CZUAA SCO-338. Municipality of Jaral del Progreso: 18-04-2009, C. García-Balderas, 1 ♀, CZUAA SCO-339; 18-04-2009, D. Valdés-Jiménez, 1 ♀, CZUAA SCO-342. Municipality of León: 21°00’32.73” N, 101°14’57.65” W, 3-06-2015, Ernestina, 1 ♀, CZUAA SCO-359. León, -06-2007, M. Ontiveros, 1 ♀, CZUAA SCO-439; 25-05-2007, M. C. Flores-Balderas, 1 ♂, CZUAA SCO-459. Municipality of Silao: -06-1986, M. Hernández A, 1 ♀, CZUAA: SCO-337. Jalisco, Municipality of Belén del Refugio: -08-1986, S. Ruvalcaba, 1 ♀, CZUAA SCO-355. Municipality of Encarnación de Díaz: 5-03-2013, C. Franco-Servín de la Mora, 1 ♀, CZUAA SCO-356; 25-05-2000, R. Guerrero-Alba, 1 ♀, CZUAA SCO-357; 15-04-2013, J. E. Díaz-Plascencia, 1 ♀, CZUAA SCO-363; 22-05-2005, K. G. Torres-Hernández, 1 ♀, CZUAA SCO-364; 7-06-2000, R. Guerrero-A, 1 ♂, CZUAA SCO-365. Zacatecas, Municipality of Valparaíso: 5-03-1999, J. G. Macías-Barragán, 1 ♀, CZUAA SCO-367.

Remarks

The municipalities recorded here include Aguascalientes, Asientos, Calvillo, Jesús María, Rincón de Romos, and San Francisco de los Romo. *Vaejovis nigrescens* is a lithophilic species distributed in the transitional area between the Trans Mexican Volcanic Belt, the Chihuahuan

Figure 14. Habitus of male (top) and female (bottom) of *V. aguazarca*, scale = 1cm.

desert, and the Sierras Madre Occidental provinces. Like *M. spadix*, *V. nigrescens* exhibits a wide distribution in Aguascalientes. Unlike the species of *Mesomexovis*, several species of the *nitidulus* species group of *Vaejovis* are distributed in the Chihuahuan desert, suggesting a different origin and species diversification compared to the genus *Mesomexovis*, maladapted to xeric environments (González-Santillán & Prendini, 2013).

Vaejovis aguazarca Díaz-Plascencia & González-Santillán 2022 (Fig. 14)

Taxonomic summary

Holotype: deposited in the Colección Nacional de Arácnidos, UNAM, México City. México, Aguascalientes, Municipality of San José de Gracia: Sierra Fría, Estación Biológica Agua Zarca, 22°05’26.00” N, 102°33’22.67” W,

2,173 m, 31-08-2015, J. E. Díaz-Placencia, J. L. Aguilar, ♂, CNAN-T01492. Paratypes 22°05'31.96" N, 102°33'27.86" W, 2,190 m, 7-09-2020. F. Chávez-Samayoa, D. F. Simijaca-Salcedo, 1 ♂, 4 ♀, CNAN-T01493; 22°05'26.00" N, 102°33'22.67" W, 2,190 m, 9-11-2020, F. Chávez-Samayoa, D. F. Simijaca-Salcedo, P. García-Macías, 1 ♂, 1 ♀, CNAN-T01494; 22°05'34.58" N, 102°33'40.03" W, 2,181m, 19-02-2021, F. Chávez-Samayoa, D. F. Simijaca-Salcedo, 1♂, CNAN-T01495.

Examined material: Mexico, Aguascalientes, Municipality of Jesús María: Presa Abelardo Rodríguez, 21°55'7.64" N, 102°24'28.62" W, 1,927 m, 8-06-2003. J. E. Valencia, 1 ♀, CZUUA SCO-382. Los Arquitos, 21°55'17.94" N, 102°23'49.39" W, 1935 m, 08-2020, F. Chávez-Samayoa, S. S. Gutiérrez-Ramírez, D. F. Simijaca-Salcedo, 1 ♀, CZUAA SCO-583; 21°55'17.94" N, 102°23'49.39" W, 1935 m, 28-11-2020, F. Chávez-Samayoa, D. F. Simijaca-Salcedo, 1 ♀, CZUAA SCO-606. Municipality of Rincón de Romos: Pabellón de Hidalgo, 22°11'18.48" N, 102°21'22.56" W, 2,046 m, 15-05-2013, H. Puga-Arévalo, 1 ♀, CZUUA SCO-386. Municipality of San Francisco de los Romo: El Chicalote, 22°00'43.26" N, 102°15'11.84" W, 1,896 m, -10-2019., M. J. Perales-Olivares, 1 ♀, CZUAA SCO-500. Muncipality of San José de Gracia: Estación Biológica Agua Zarca, 22°05'31.96" N, 102°33'27.86" W, 2,190 m, 7-09-2020, F. Chávez-Samayoa, D. F. Simijaca-Salcedo, 3 ♂, 6 ♀, CZUAA SCO-552; 22°05'33.18" N, 102°33'26.21" W, 2,190 m, 9-09-2020, F. Chávez-Samayoa, D. F. Simijaca-Salcedo, P. García-Macías, 5 ♂, CZUAA SCO-571; 22°05'34.58" N, 102°33'40.03" W, 2,181 m, 19-02-2021, F. Chávez-Samayoa, D. Fernando Simijaca-Salcedo, 1 ♂, CZUAA SCO-608; 22°05'31.92" N, 102°33'27.72" W, 1-04-2021, F. Chávez-Samayoa, D. F. Simijaca-Salcedo, A. Jaime, 23 ♀, CZUAA SCO-702; 22°05'33.73" N, 102°33'53.21" W, 2,201 m, J. E. Díaz-Plascencia, C. Franco-Servín de la Mora, 1 ♂, 2 ♀, CNAN-S4005.

Remarks

Vaejovis aguazarca presents the most accentuated sexual dimorphism with body size at 23 ♂ and 32 ♀ mm among the *mexicanus* group species distributed in Aguascalientes. *Vaejovis aquascalentensis* Chávez-Samayoa & González-Santillán (2022), in contrast, is a medium size scorpion at 28 ♂ and 30 ♀ mm, and *V. tenamaztlei* Contreras-Félix et al. (2015), the smallest of them, is at 20 ♂ and 25 ♀ mm. The original description of *Vaejovis aguazarca* includes a detailed description of the natural history of the 3 species of this species group (Chávez-Samayoa et al., 2022). The authors indicated that the species uses a broad habitat, including oak bark nooks, under rocks, the base of yucca trees, and leaf litter, among others, as a refuge. The species also presents a peak of superficial activity during the rainy season, and it appears to be a well-separated altitudinal niche use when contrasted with *V. aquascalentensis* and *V. tenamaztlei*. *Vaejovis aguazarca* uses altitudinal levels between 1,927 and 2,201 m, whereas *V. tenamaztlei* uses between 2,390 and 2,864 m, a sharp difference of 100 m. However, *V. aquascalentensis* overlaps both altitudinal ranges from 1,601 to 2,367 m. Another difference is that *V. tenamaztlei* and *V. aguazarca* extend their distribution within the Sierra Madre Occidental and the Chihuahuan desert provinces (Chávez-Samayoa et al., 2022, their Fig. 22), whereas *V. aquascalentensis* seems to occupy the Pacific lowlands within Aguascalientes.

Vaejovis aquascalentensis Chávez-Samayoa & González-Santillán, 2022 (Fig. 15)

Taxonomic summary

Holotype: deposited in the Colección Nacional de Arácnidos, UNAM, México City. Mexico, Aguascalientes, Municipality of Calvillo: Presa Los Alamitos, 21°43'49.85" N, 102°42'50.51" W, 2,367 m, 24-05-2021, F. Chávez-Samayoa, M. E. Samayoa-Sepúlveda ♂, CNAN-T 01496. Paratypes: 21°43'49.85" N, 102°42'50.51" W, 2,367 m, 17-05-2021, F. Chávez-Samayoa, D. Ortíz-Álvarez, 2 ♂, 1 ♀, CNAN-T01497. Presa el Adobe, inside a narrow canyon, 21°48'20.12" N, 102°40'55.99" W, 2,026 m, 3-08-2017, J. E. Díaz-Plascencia, E. González-Santillán, 3 ♂, CNAN-T01498.

Remarks

Vaejovis aquascalentensis was first recorded in the state as an undescribed species of *Pseudouroctonus* by Escoto-Rocha & Delgado-Saldívar (2008). However, Chávez-Samayoa et al. (2022) examined the specimens and concluded that the species belongs to the *mexicanus* species group. Likely, this species is also distributed in Jalisco and Zacatecas, although more fieldwork is required to confirm this supposition.

Vaejovis tenamaztlei Contreras-Félix, Francke & Bryson Jr., 2015 (Fig. 16)

Taxonomic summary

Holotype: deposited in the Colección Nacional de Arácnidos, UNAM, México City, México. México, Aguascalientes, Municipality of Calvillo: 3 km to the east of Alamitos dam, Sierra del Laurel, 21º44'07.12" N, 102º41'51.11" W, 2,440 m, 24-07-2012, O. Francke, G. Contreras, D. Barrales, A. Valdez, 1 ♂, CNAN-T0871, paratypes same locality, 1 ♂, 3 ♀, CNAN T-0872 and Los

Figure 15. Habitus of male (top) and female (bottom) of *V. aquascalentensis*, scale = 1 cm.

Alisos, Sierra del Laurel, 21º43’32.20” N, 102º42’01.40” W, 2,415 m, 10-01-2011. J. C. Arenas. 1 ♂ deposited in the American Museum of Natural History.

Examined material: Mexico, Aguascalientes, Municipality of Calvillo: Presa Los Alamitos, 21°43’49.44” N, 102°42’50.04” W, 2,368 m, 14-06-2021 F. Chávez-Samayoa, M. E. Samayoa-Sepúlveda, 2 ♂, 5 ♀, CZUAA SCO-616; 17.v.2021, F. Chávez-Samayoa, D. Ortiz-Álvarez, 5 ♂, 5 ♀, CZUAA SCO-632. Municipality of El Llano: Juan el Grande, 21°55’54.01” N, 101°55’06.18” W, 2,495 m, 18-10-2019, F. Chávez-Samayoa, E. González-Martínez, 1 ♀, CZUAA SCO-586; 21°56’22.88” N, 101°55’18.19” W, 2,390 m, 27-09-2020 F. Chávez-Samayoa, D. F. Simijaca Salcedo, I. E. Gallegos Vieyra, 2 ♂, 1 ♀, CZUAA SCO-566; 21°56’21.77” N, 101°55’18.30” W, 2,386 m, 25-09-2020, F. Chávez-Samayoa, D. F. Simijaca-Salcedo, P. C. Hernández-Romero, 7 ♂, 1 ♀, CZUAA SCO-567. Municipality of San José de Gracia:

Figure 16. Habitus of male (top) and female (bottom) of *V. tenamaztlei*, scale = 1 cm.

Monte Grande, 22°15’44.50” N, 102°37’43.03” W, 2,864 m, 19-09-2019, F. Chávez-Samayoa, J. J. Ayala-Rodríguez, R. Rosales, C. Franco-Servín de la Mora, E. Quiroz, 2 ♂, 3 ♀, CZUAA SCO-506; 22°15’44.50” N, 102°37’43.03” W, 2,864 m, 8-10-2019, F. Chávez-Samayoa, J. J. Ayala-Rodríguez, E. Quiroz, E. González-Martínez, 3 ♂, 2 ♀, CZUAA SCO-481.

Remarks

Vaejovis tenamaztlei was the first member of the *mexicanus* species group recorded in Aguascalientes and most likely is also distributed in Jalisco and Zacatecas. Like other species of the group, this species can be found in oak forests of the municipalities of Calvillo, El Llano and San José de Gracia (Chávez-Samayoa et al., 2022).

Key to identification of the scorpion genera and species of Aguascalientes Mexico.

1. Cheliceral movable finger ventral medial denticle present (Fig. 2A); pedipalp chela fixed and movable finger denticles disposed as imbricated rows (Fig. 17A); pedipalp patella trichobothrial set v_1-v_3 absent (Fig. 18A), subtriangular sternum [Buthidae/*Centruroides*] 2

- Cheliceral movable finger ventral medial denticle absent (Fig. 2B, C); pedipalp chela fixed and movable fingers denticles aligned as a straight line of retrolateral and prolateral denticles (Fig. 17B); pedipalp patella trichobothrial set v_1-v_3 present (Fig. 18B); pentagonal sternum (Diplocentridae/ Vaejovidae) 3

2. Carapace with each median ocelli surrounded by an incomplete areola of pigmentation; (Fig. 4A); pectinal basal piece with a central depression (Fig. 19A), pectinal tooth count 24-28 in males and 22-25 in females..... ..... *Centruroides balsasensis*

- Carapace with each median ocelli surrounded by a complete areola of pigmentation; (Fig. 4B); pectinal basal piece without central depression (Fig. 19B); pectinal tooth count 23-24 in males and 20-21 in females..... ..... *Centruroides infamatus*

3. Pedipalp patella, dorsal retrolateral carina obsolete (Fig. 20A); telotarsi ventral macrosetae spiniform, ventral spinule row absent (Fig. 21A), telson with evident blunt subaculear tubercle (Fig. 22A) ....Diplocentridae/ *Diplocentrus zacatecanus*

- Pedipalp patella, dorsal retrolateral carina granular or costate (Fig. 20B, C), telotarsi ventral macrosetae slender, ventral spinule row present (Fig. 21B, C), telson without subaculear tubercle (Fig. 22B) ..... Vaejovidae 4

4. Trichobothria ib and it located at the level of chela fixed finger sixth prolateral denticle (Syntropinae Fig. 23A) 6

- Trichobothria ib and it located basal to of chela fixed finger sixth prolateral denticle (Smeringurinae/Vaejovinae, Fig. 23B, C)..... 5

5. Carapace, anterior margin bilobate (*Diplocentrus*) or nearly straight, ocular tubercle dorsal margin below carapace surface (Fig. 24 A, C); metasomal segments I-IV dorsal lateral carinae terminus with a spiniform denticle (Fig. 25A).. 10

- Carapace, anterior margin concave; ocular tubercle dorsal margin above carapace surface (Fig. 24B); metasomal segments I-IV dorsal lateral carinae terminus without spiniform denticles (Fig. 26) ..... *Paruroctonus gracilior*

6. Telson, dorsal surface with small fusiform, whitish glandular area anterior to base of aculeus (Fig. 27A) (minute to obsolete in *Chihuahuanus bilineatus*) [*Chihuahuanus*]..... 7

- Telson, dorsal surface without small fusiform, whitish glandular area anterior to base of aculeus (Fig. 27B) (*Mesomexovis*/ *Thorellius*)..... 9

7. Pedipalp patella, dorsal retrolateral carina obsolete (Fig. 28A); metasomal segments I-IV ventral lateral and ventral submedian carinae obsolete but strongly infuscated (Fig. 29A, B); telson caudal gland minute to obsolete..... ..... *Chihuahuanus bilineatus*

-Pedipalp patella dorsal retrolateral carinae granular or weakly granular (Fig. 28B); metasomal segments III-IV ventral carinae granular (Fig. 29C); telson caudal gland fusiform and evident 8

8. Carapace, pedipalp, terguites, and legs with evident dorsal patterns of infuscation (Fig. 30A); sternite VII with setae non arranged in a linear path (Fig. 31A) ..... *Chihuahuanus coahuilae*

-Carapace and terguites with faint dorsal patterns of infuscation (Fig. 30B), pedipalps and legs immaculate; sternite VII with setae arranged in a linear path (Fig. 31B) ..... *Chihuahuanus glabrimanus*

9. Chelicerae dorsal manus with 2 or more macrosetae (Fig. 2B); pedipalp chela carinae obsolete, fingers without median lobe, movable finger with a single denticle on seventh position; pectinal tooth count 20-21 in males, 17-18 in females; metasomal segments I-IV ventral carinae obsolete but with marked infuscation (Fig. 32) ..... *Mesomexovis spadix*

- Chelicerae dorsal manus with 1 macrosetae (Fig. 2C); pedipalp chela carina granular, fingers with median lobe present, movable finger with a pair of denticles on seventh position; pectinal tooth count 23-25 in males, 20-22 in females; metasomal segments I-IV ventral carina costate without infuscation (Fig. 33)..... *Thorellius intrepidus*

10. Carapace anterior margin with 4 pairs of macrosetae; general coloration dark brown; pectinal tooth count 19-21 in males and 17-21 in females; metasomal segments I-IV ventral submedian carinae obsolete (Fig. 25B)..... ..... *Vaejovis nigrescens*

- Carapace anterior margin with 3 pairs of macrosetae; general coloration light brown to reddish; pectinal tooth count 14-16 in males and 12-14 in females; metasomal segments I-IV ventral submedian carinae granular (Fig. 29C)..... 11

11. Pedipalp chela dorsal carinae immaculate; telotarsi ventral spinules grouped as a cluster (Fig. 34A); adult male telson dorsal surface with conspicuous hyaline glandular area (Fig. 27C)..... *Vaejovis tenamaztlei*
- Pedipalp chela dorsal carinae infuscated; telotarsi ventral spinules disposed as a straight row (Fig. 34B); adult male telson dorsal surface without conspicuous hyaline glandular area (Fig. 27B)..... 12
12. Chelicerae dorsal manus with 1 macrosetae (Fig. 2A, C); pedipalp femur retrolateral dorsosubmedian carina composed of 6 or 7 granules; chela movable finger with 7 prolateral and 6 retrolateral denticles .... *Vaejovis aguazarca*
- Chelicerae dorsal manus with 2 macrosetae (Fig. 2B); pedipalp femur retrolateral dorsosubmedian carinae costate in males or weakly granular in females; chela movable finger with 7 prolateral and retrolateral denticles..... ..... *Vaejovis aquascalentensis*

Figure 17. Movable finger of *C. infamatus* (A) showing imbricated tooth rows, and *M. spadix* (B) showing aligned retrolateral and prolateral denticles.

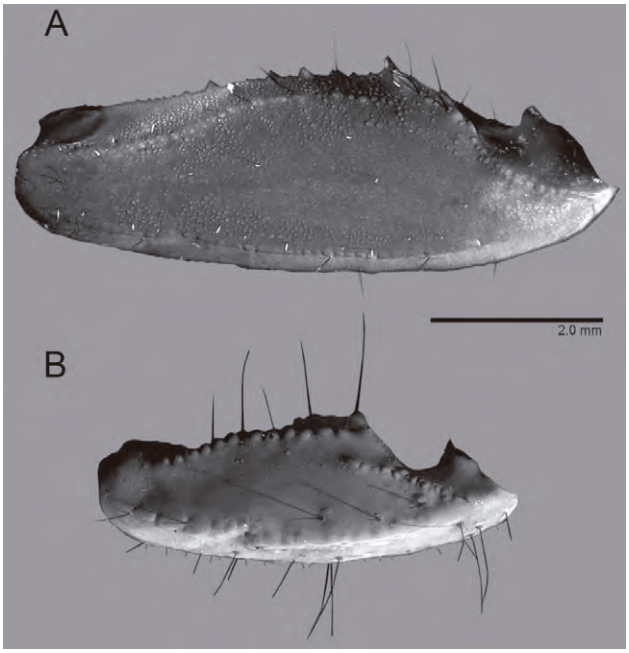

Figure 18. Ventral view of pedipalp patella of *C. infamatus* (A), and *Chihuahuanus glabrimanus* (B).

Discussion

Despite being one of the smallest states of Mexico, the topography, climatic, and environmental conditions create a combination of factors that enhance biological diversity in Aguascalientes. Currently, Aguascalientes scorpion fauna comprises 13 species within the families Buthidae, Diplocentridae, and Vaejovidae (Table 1). Nonparametric estimations led us to conclude that the CZUAA currently holds a complete sample of the state's diversity. Although these estimations must be taken, cautionary, as a lower bound of the actual species richness (Chao, 1984), this is especially true in taxa like scorpions with low vagility (Bryson Jr. et al., 2013), some of which are specialized in distinct microhabitats, making them less prone to be

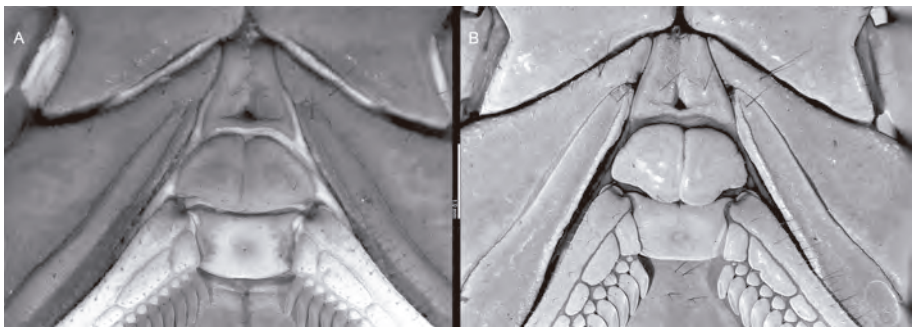

Figure 19. Coxosternal area and pectinal basal piece of *C. balsasensis* (A), and *C. infamatus* (B).

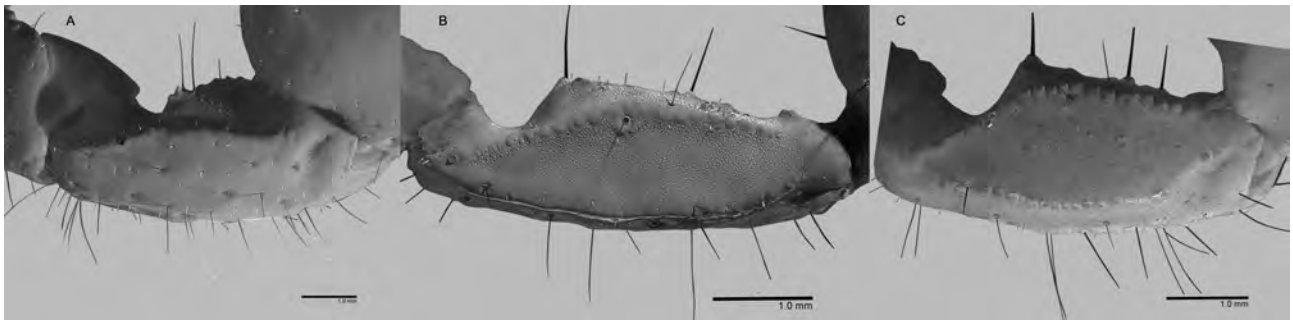

Figure 20. Dorsal view of pedipalp patella of *D. zacatecanus* (A), *V. aquascalentensis* (B), and *T. intrepidus* (C).

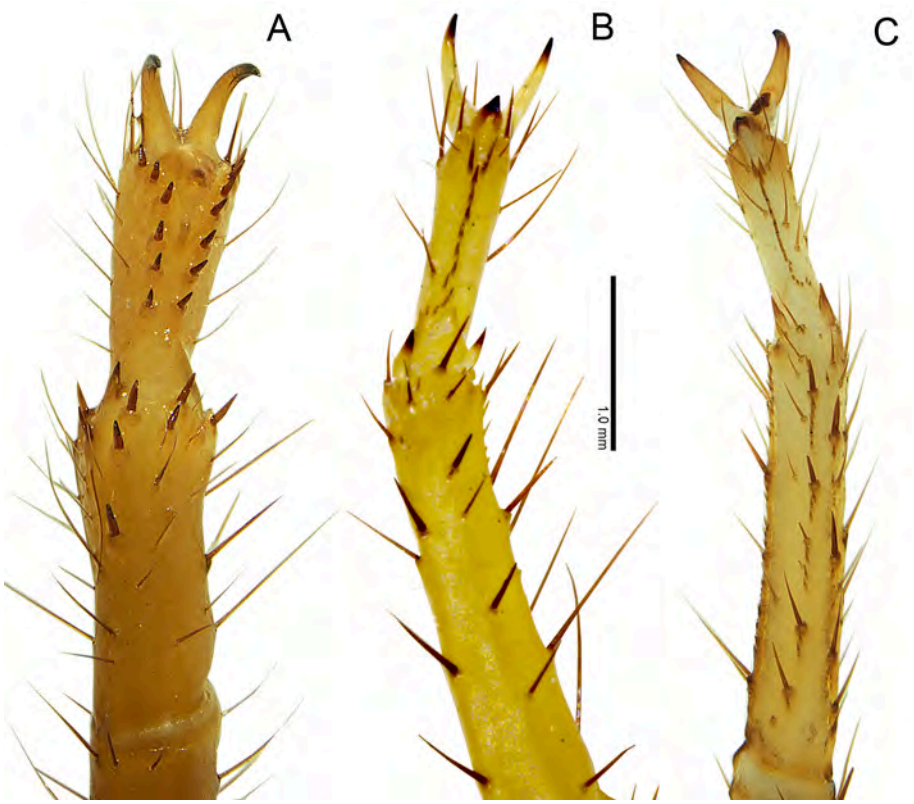

Figure 21. Ventral view of leg III of *D. zacatecanus* (A), *P. gracilior* (B), and *V. nigrescens* (C).

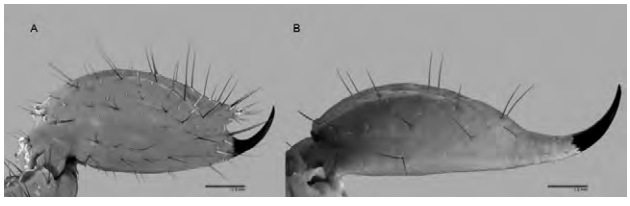

Figure 22. Lateral view of telson of *D. zacatecanus* (A), and *M. spadix* (B).

collected. In these terms, if we consider the upper limit that results from the sum of the standard error to the expected species number of each estimator reported in Table 2, the completeness of the CZUAA's species inventory might be between 85.7-100% under the 10 × 10 km grids approach and between 92.3-100% under the 5-year classes approach. This last result can be explained by the fact that, under this approach, *P. gracilior* and *V. tenamaztlei* are doubletons, and thus, the calculation of Jackknife 2

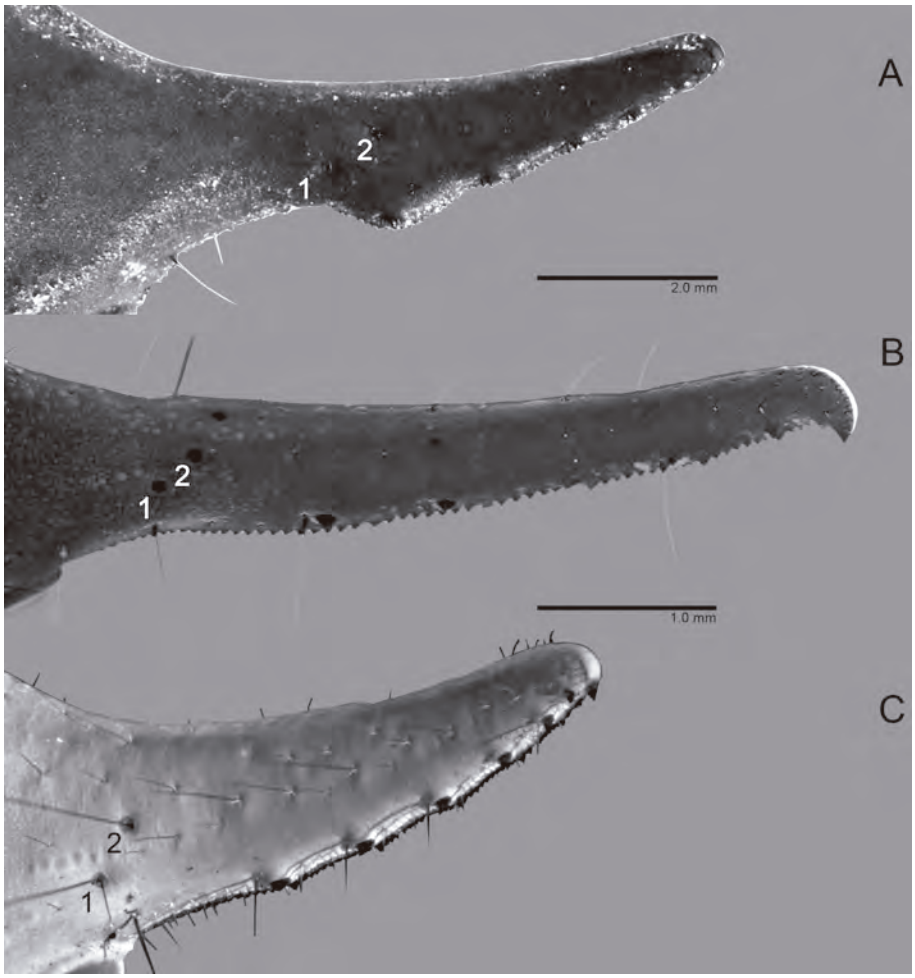

Figure 23. Chela fingers of *T. intrepidus* (A), *V. nigrescens* (B), and *P. gracilior* (C). Trichobothria signaled as follows: 1 = internal basal, 2 = internal terminal.

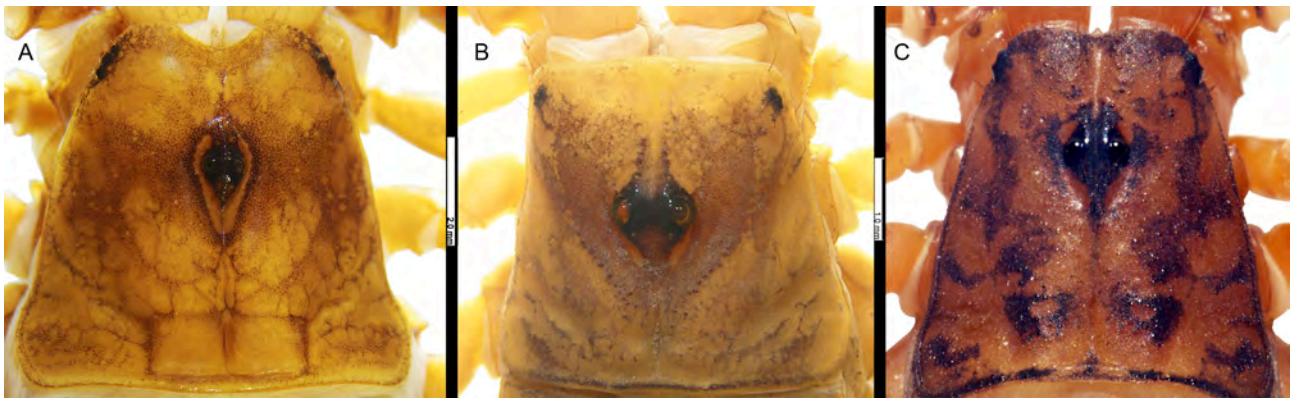

Figure 24. Carapace of *D. zacatecanus* (A), *P. gracilior* (B), and *Vaejovis tenamaztlei* (C).

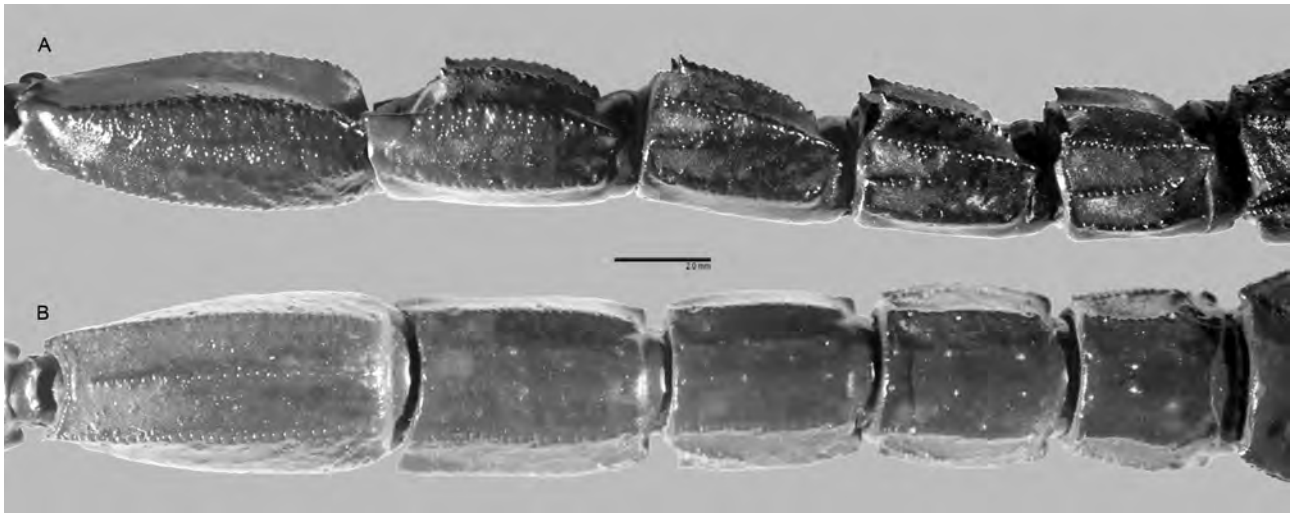

Figure 25. Lateral (A), and ventral (B) view of the metasoma of *V. nigrescens*.

Figure 26. Lateral view of the metasoma of *P. gracilior*.

resulted above 100%. Another factor to consider is that we are taking political boundaries as species limits, which make little sense in biological systems but result in a pragmatic approach. Our goal is to produce information that can be used for decision-makers.

The key provided by Hoffmann (1931) in his original monography distinguishes *M. spadix* from *M. punctatus* Karsch based on the body base color and a higher pectinal tooth count, which led him to consider it as a subspecies. However, more recent contributions found

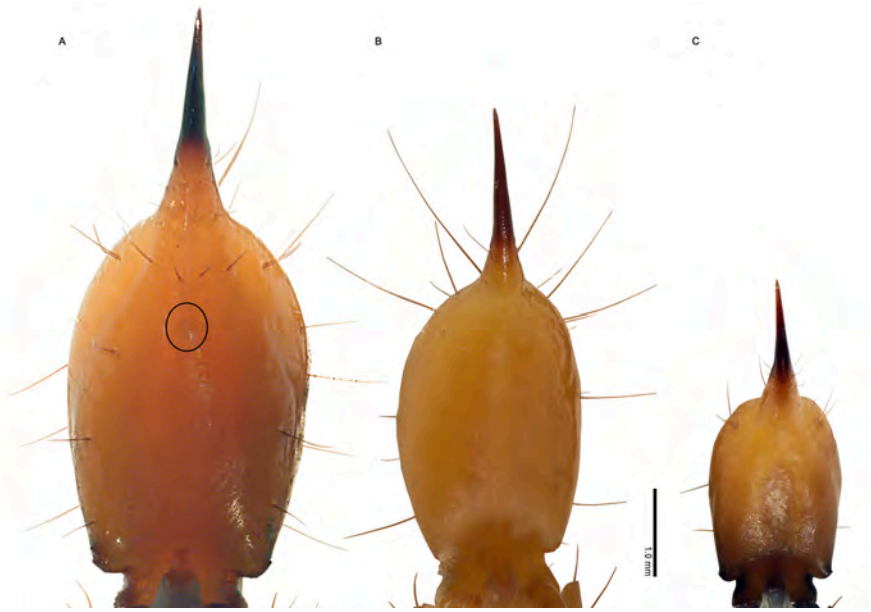

Figure 27. Dorsal view of telson of *C. glabrimanus* (A), *P. gracilior* (B), and *V. tenamaztlei* (C).

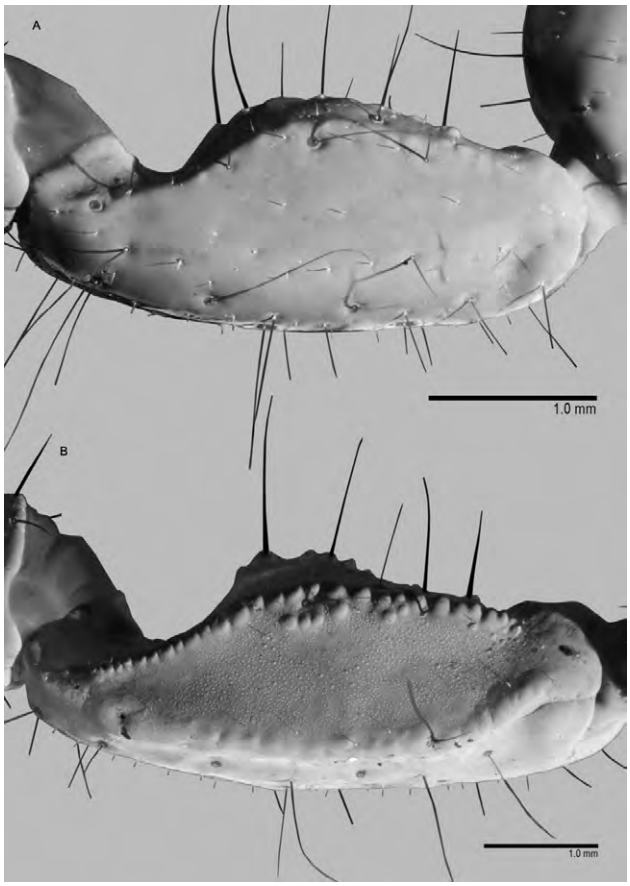

Figure 28. Dorsal view of pedipalp patella of *C. bilineatus* (A), and *C. glabrimanus* (B).

Figure 29. Ventral view of metasoma of *C. bilineatus* (A, B), and *C. glabrimanus* (C).

further characteristics that differentiate these species. For instance, Fet et al. (2006) presented SEM micrographs of *M. punctatus* with 2-8 denticles conforming laterobasal aculear serrations (LAS) on the aculeus; however, the specimens of *M. spadix* examined under UV light during this study do not possess LAS. Finally, *M. variegatus* is devoid of ventral median carinae in metasomal segment V (Santibáñez-López & Sissom, 2010), which is present in *M. spadix* (Fig. 32).

Figure 30. Carapace of *C. coahuilae* (A), and *C. glabrimanus* (B).

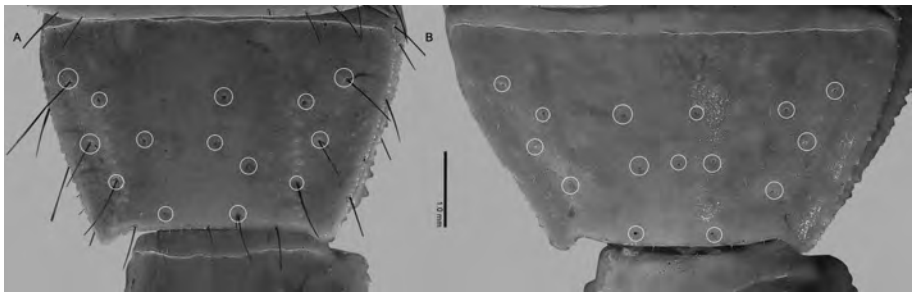

Figure 31. Sternite VII of *C. coahuilae* (A), and *C. glabrimanus* (B).

Figure 32. Ventral view of the metasoma of *M. spadix.*

Figure 33. Ventral view of the metasoma of *T. intrepidus*.

This contribution is one of the few that present a taxonomic identification key to the species of a political state in Mexico. Currently, only the Mexican states of Baja California, Baja California Sur, Estado de México, and Morelos have a taxonomic key that allows determination to species level (Córdova-Athanasiadis, 2005; González-Santillán, 2004; Williams, 1980).

Natural history collections (NHC) are an invaluable source of information for evolutionary, ecological, taxonomical, and biogeographical research, as well as future applications and yet unexplored fields (Miller et al., 2020). Researchers focused on diverse taxonomical groups such as mammals (McLean et al., 2016), corals (Hoeksema et al., 2011), insects (Kharouba et al., 2019), parasites (Harmon et al., 2019), among others have also stressed the importance of NHC for the evaluation of impacts on biodiversity due to global change and human impact (Shaffer et al., 1998). At the same time, several authors have pointed out a decline in collecting activities and the deposition of specimens due to factors ranging from decline of taxonomical expertise to funding (Rohwer et al., 2022; Salvador & Cunha, 2020; Thompson et al., 2021), increasing regulations and ethical concerns. This contribution epitomizes the importance of local and regional NHCs because without the empirical evidence provided by the CZUAA and the CNAN, this contribution would not be possible, and valuable resources and information, such as a taxonomic key and the recognition of introduced species of public health importance, such as *C. balsasensis*, would have required comparatively more effort and time to discover.

Figure 34. Ventral view of the telotarsi of *V. tenamaztlei* (A), and *V. aquascalentensis* (B).

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Appendix 1. Database of species incidence on a 10 × 10 km grid covering the state of Aguascalientes number of grids (n) = 61. Abbreviations as follows: *C. inf = Centruroides infamatus, C. bil = Chihuahuanus bilineatus, C. coa = Chihuahuanus coahuilae, C. gla = Chihuahuanus glabrimanus, D. zac = Diplocentrus zacatecanus, M. spa = Mesomexovis spadix, P. gra = Paruroctonus gracilior, T. int = Thorellius intrepidus, V. agu = Vaejovis aguazarca, V. aqu = Vaejovis aquascalentensis, V. nig = Vaejovis nigrescens, V. ten = Vaejovis tenamaztlei*.

C. inf	*D. zac*	*C. bil*	*C. coa*	*C. gla*	*M. spa*	*P. gra*	*T. int*	*V. agu*	*V. aqu*	*V. nig*	*V. ten*
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	1	0	0	0	0	0	1
1	0	0	0	1	1	0	1	0	1	0	1
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	1	0	0	0	0	0	0
1	0	0	0	0	1	0	0	0	0	0	0
1	0	0	0	0	1	0	0	0	1	0	0
0	0	0	0	0	1	0	0	0	1	0	0
0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	1	0	0	0	0
1	0	0	0	0	1	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	1	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0
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1	0	1	1	1	1	0	0	1	0	1	0
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0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	1	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	1	0	0	1	0	0	1	0	0	0
0	0	0	1	1	0	0	0	1	0	1	0
1	0	0	0	0	1	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0

Appendix 1. Continued

C. inf	*D. zac*	*C. bil*	*C. coa*	*C. gla*	*M. spa*	*P. gra*	*T. int*	*V. agu*	*V. aqu*	*V. nig*	*V. ten*
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	1	0	0	0	0	0	1	0
0	0	0	0	1	0	0	0	0	0	0	0
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0	1	0	0	0	0	0	0	0	0	0	0
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0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	1	0
0	0	0	1	0	0	0	0	0	0	0	0
0	1	1	0	1	1	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0

Appendix 2. Database of species incidence in Aguascalientes in 5 years classes, number of classes (n) = 9. Abbreviations as follows: *C. inf* = *Centruroides infamatus*, *C. bil* = *Chihuahuanus bilineatus*, *C. coa* = *Chihuahuanus coahuilae*, *C. gla* = *Chihuahuanus glabrimanus*, *D. zac* = *Diplocentrus zacatecanus*, *M. spa* = *Mesomexovis spadix*, *P. gra* = *Paruroctonus gracilior*, *T. int* = *Thorellius intrepidus*, *V. agu* = *Vaejovis aguazarca*, *V. aqu* = *Vaejovis aquascalentensis*, *V. nig* = *Vaejovis nigrescens*, *V. ten* = *Vaejovis tenamaztlei*.

	C. inf	*D. zac*	*C. bil*	*C. coa*	*C. gla*	*M. spa*	*P. gra*	*T. int*	*V. agu*	*V. aqu*	*V. nig*	*V. ten*
1979-83	1	1	0	0	1	1	0	0	0	1	0	0
1984-88	1	0	1	0	1	1	0	0	0	0	1	0
1989-93	1	1	0	1	1	1	0	0	0	0	0	0
1994-98	1	0	0	1	1	1	0	0	0	0	1	0
1999-03	1	0	1	0	1	1	0	1	1	0	0	0
2004-08	1	1	1	1	1	1	0	0	1	0	1	0
2009-13	1	1	0	0	1	1	0	0	1	1	1	0
2014-18	1	1	1	1	1	1	1	1	1	1	1	1
2019-22	1	1	1	1	1	1	1	1	1	1	1	1

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